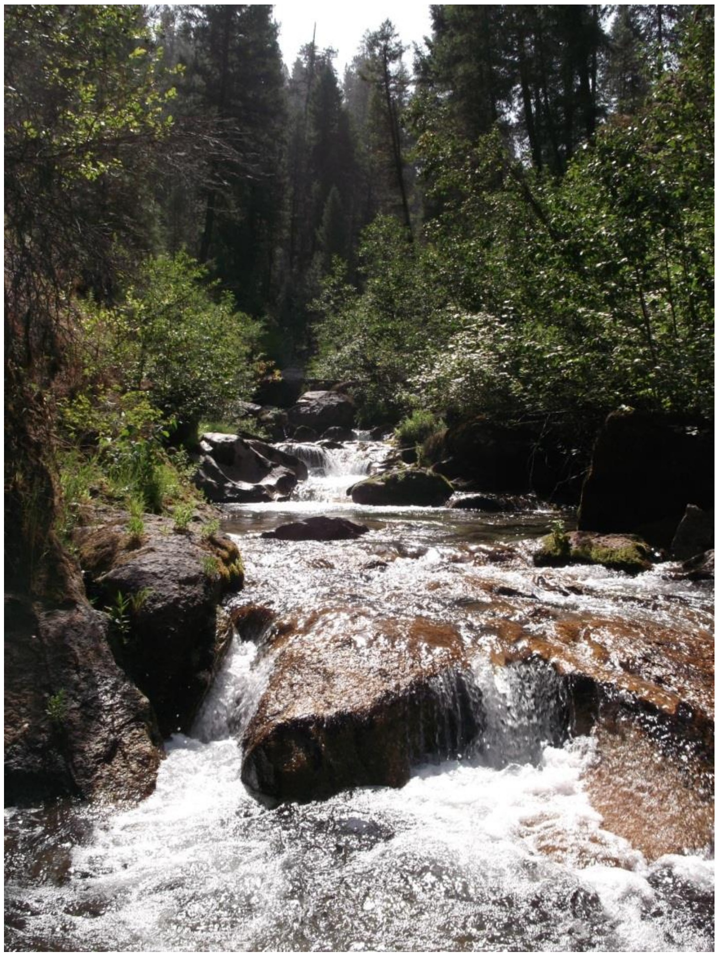
Water Body Assessment Guidance

3rd Edition—Draft



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Prepared by
Idaho Department of Environmental Quality
Water Quality Division
1410 North Hilton
Boise, Idaho 83706

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1 Water Body Assessment Guidance Overview

1.1 Intent

This Water Body Assessment Guidance (WBAG) describes the Idaho Department of Environmental Quality (DEQ) methods used to consistently evaluate data and determine beneficial use support of Idaho water bodies. The methodology addresses many reporting requirements of state and federal rules, regulations, and policies. This is the third edition of the WBAG, and it is intended as an analytical tool to guide the assessor through a standardized assessment of beneficial use status.

1.2 Overview of the Surface Water Program and the Assessment Process

As the agency responsible for protecting Idaho's surface water, DEQ monitors and assesses the quality of the state's rivers, streams, and lakes. This information is used to report to the US Environmental Protection Agency (EPA) and to make decisions regarding water quality management. The following discussion outlines the assessment process.

Step 1. Collect Data

The Surface Water Ambient Monitoring Plan (DEQ 2012) outlines DEQ's approach to collecting and integrating ambient water quality monitoring data from a variety of monitoring programs, including the Beneficial Use Reconnaissance Program (BURP), National Aquatic Resource Surveys, Trend Monitoring Network, and special studies.

DEQ's BURP sends crews into the field to collect water temperature data, biological samples (e.g., fish, bacteria), chemical measures (e.g., specific conductivity, which measures the ability of water to pass an electrical current), and habitat data from Idaho's surface water. In addition to its own data collection efforts, DEQ also solicits and considers data submitted from outside sources such as the US Forest Service, Idaho Department of Fish and Game, and EPA.

Step 2. Assess Data and Determine Beneficial Use Support

Using BURP and other data and the methods described in this WBAG, DEQ determines if each of Idaho's water bodies meets water quality standards and supports beneficial uses.

Step 3. Write and Submit Required Reports

DEQ is required to submit its Integrated Report to EPA. The report describes the quality of all of Idaho's water bodies and identifies and prioritizes the state's water quality problems. This report is based on the data collected and analyzed in steps 1 and 2 and is submitted to EPA approximately every 2 years.

Step 4. Evaluate Impaired Waters to Determine Causes and Sources of Pollutants

Where water quality fails to meet state water quality standards (as documented in the Integrated Report), DEQ evaluates the water body to determine the causes and sources of pollutants. This analysis is documented in a subbasin assessment. Additional data are collected to complete the subbasin assessment. This assessment is the first step to either developing a total maximum daily load (TMDL) or recommending removing the water body from the list of impaired waters.

Step 5. Establish Total Maximum Daily Loads for Water Bodies

Using information from the subbasin assessment, DEQ establishes a TMDL for each impaired water body. The TMDL sets maximum allowable levels for the pollutants causing water quality violations.

Step 6. Develop an Implementation Plan

An implementation plan is written after a TMDL is developed. The plan provides details of the actions needed to achieve pollutant load reductions and outlines a schedule of those actions. The plan also specifies monitoring needed to document action and progress toward meeting water quality standards.

Step 7. Continue to Monitor and Analyze Water Bodies

The implementation plan specifies monitoring methods to determine if the recommended changes are improving water quality and if and when water quality standards are being met. If a water body was found to be meeting water quality standards in steps 2, 3, or 4 (that is, no TMDL or implementation plan was written), it will be monitored again in the future to ensure it continues to meet standards.

1.3 How to Use This Document

This document provides the assessor with guidance throughout the water body assessment process. Such guidance includes information on DEQ policies, assumptions, and analytical methods. However, the document does not present a rigid structure limiting flexibility for unique situations or preclude the use of sound scientific judgment. In these situations, it is the DEQ assessor's responsibility to provide justification for variations from the guidance.

The design of this document is intended to guide an assessor through the complete assessment process from beginning to end. An assessment entails analyzing and integrating multiple types of water body data—such as physical, chemical, biological, and landscape—to address the following objectives:

1. Identify water body type and assessment units to be assessed (section 2).
2. Determine beneficial uses to be assessed—identify designated, existing, or presumed uses (section 3).
3. Assemble available data; evaluate applicability of internal and external data for assessment purposes (section 4).
4. Evaluate data to determine if there are any narrative or numeric criteria exceedances (section 5).

5. Determine aquatic life use support status based on appropriate indices (section 6).
6. Determine contact recreation support status based on appropriate data (section 7).
7. Determine water supply and wildlife habitat and aesthetics use support status (section 8 and 9).

Although the document is structured to guide an assessor through the process from start to finish, assessors may find that they often need to refer to certain sections to answer specific questions. The organization of this document should facilitate this use, although assessors may need to refer back to previous sections to gain proper context.

2 Water Body Types and Assessment Units

Idaho is home to abundant fresh water in the form of lakes, reservoirs, rivers, streams, springs, man-made canals, and wetlands. Assessors may encounter data from many different water body types. In the section of the Idaho Code that authorizes DEQ to adopt Water Quality Standards, the legislature defines "waters or water body" as "the navigable waters of the United States as defined in the federal clean water act" (Idaho Code §39-3602(34)).

This section provides more information on various types of water bodies, which ones are applicable to this assessment process, and how they are identified for assessment purposes.

2.1 Water Body Types

This WBAG applies primarily to perennial lotic (running) water bodies. It applies to both reconnaissance and more intensive monitoring and to both wadeable and nonwadeable water bodies. Although the fundamental index of biotic integrity approach should also be applicable to lakes, reservoirs, springs, and wetlands, DEQ must further investigate these types of water bodies to develop scientifically sound bioassessment processes when applying the multimetric approach described here. However, numeric and narrative criteria do apply to these waters, and the approach outlined in this guidance should be followed when assessing these waters.

The Idaho water quality standards define waters (IDAPA 58.01.02.010); however, it is not an inclusive list (e.g., wetlands are not defined in the Idaho water quality standards). Currently, DEQ does not have assessment protocols for all water body types in the state, nor are the Idaho water quality standards definitions mindful of all the factors affecting an assessment. A few of the types of waters that are not covered by this assessment process include the following:

- Springs—a point where ground water flows out of the ground where the aquifer surface meets the ground surface.
- Ground water—a supply of freshwater from either rain or snow that has soaked into the ground may travel long distances before discharging to streams and other water bodies. Ground water discharge that provides all the water to a stream is termed baseflow.
- Surface runoff—visible overland flow that is outside of channels. Surface runoff can occur in high-intensity rainfall events or rain-on-snow events. During rainy periods, ephemeral and intermittent streams have surface runoff as their primary source of water.
- Effluent—a point source discharge of treated or untreated wastewater. During some seasons, effluent may be the only source of flow to an otherwise dry stream.

- Canals, ditches, and other man-made waterways.

2.1.1 Intermittent and Ephemeral Waters

The terms perennial, intermittent, and ephemeral speak to the persistence of natural streamflow. At any given time, a gradient of streamflow exists in a drainage network, diminishing as one goes upstream. Perennial waters have some flow all year long the majority of the time (a specific definition is waters that flow more than 90% of the time in a well-defined channel). Moving upstream in the watershed, the water body will gradually change to a stream that is more intermittent in character. These waters also have a defined stream channel but will periodically go dry within any given year. At the very uppermost stretches of a watershed, ephemeral streams may exist. These flow only during and for short periods following precipitation events. These types of water bodies may or may not have a well-defined channel and may be referred to as washes, gullies, or sloughs.

Intermittent waters naturally occur throughout Idaho; approximately 42,754 miles of streams (about 45% of the state total) are identified as intermittent by the US Geological Survey (USGS) in the National Hydrography Dataset, a digital representation of waters for use with GIS. According to Idaho's water quality standards, if a surface water body is intermittent (i.e., has zero flow for at least 1 week during most years), numeric criteria apply only during periods of "optimum" flow. For recreation, optimum flow is equal to or greater than 5 cubic feet per second (cfs); for aquatic life beneficial uses, the optimum flow is equal to or greater than 1 cfs (IDAPA 58.01.02.010.54 and .02.070.06). This provision only applies to non-perennial waters; numeric criteria always apply to perennial waters, regardless of flow.

DEQ's current multimetric biological indices are not appropriate to apply to intermittent, dewatered, or ephemeral streams. DEQ's biological indices were developed based on community composition and function typical of an expected reference condition. Reference conditions are persistent aquatic habitats (perennial waters) that allow full development of aquatic communities. Temporary waters will never have similar composition and function as perennial waters. DEQ does not have a specific protocol for monitoring or assessing intermittent or ephemeral waters.

2.1.2 Springs and Lake Outlets

Data from lake outlets and springs can require different monitoring protocols and/or different benchmarks for assessment. Assessment of springs and lake outlets are addressed on a case-by-case basis at the discretion of the assessor. Generally, springs and lake outlets differ biologically from free-flowing streams and therefore require a unique assessment tool. Multimetric macroinvertebrate indices, such as the stream macroinvertebrate index (SMI2), are not suitable for use in these atypical natural stream types. Macroinvertebrate communities from spring-fed streams and lake outlets may have very low natural diversities and would receive very low index scores, even under pristine conditions (see Maret et al. 2001; Maret et al. 1997; and Anderson and Anderson 1995 reviewed in Mebane 2002).

2.1.3 Lakes, Ponds, and Reservoirs

While examples of lotic (running) waters are fairly straightforward, the differences become subtle when rivers widen and current slows such that the river could be considered a lake, pond, or reservoir. Lakes, ponds, and reservoirs are examples of lentic (standing) waters. Lentic water body types do not fit into DEQ's current biological assessment process but can be monitored using other protocols and assessed for physical and chemical parameters with water quality standards criteria.

Lakes are either natural or man-made. Natural lakes can be considerably larger than ponds, although there is not a technical definition that can be used to distinguish between the two. *Generally,* a pond is distinguished from a lake by the following characteristics:

- Light reaches the bottom of the deepest point of a pond.
- Waves on ponds are generally smaller than 1 foot (30 cm) tall.
- A pond is relatively uniform in temperature.

Some natural lakes were formed by glaciers and tend to be deeper than man-made lakes. Rivers may occasionally form oxbow lakes when portions of a river become geologically separated from the main flowpath over time. In Idaho, man-made lakes and reservoirs have been built or enhanced for agricultural, municipal, or recreational uses. Reservoirs are created by damming and flooding a stream channel or a river valley, so their shape and size depend on the local topography. Reservoirs tend to be long, narrow, and shallow with a large watershed drainage area. Both lakes and reservoirs are subject to thermal stratification. Reservoirs that are operated as a "run of the river" reservoir system retain characteristics of both lotic and lentic water bodies, complicating the assessment process. Assessors should determine appropriate methods for assessing these types of reservoirs.

2.1.4 Wetlands

Idaho has approximately 712,270 acres of mapped wetlands according to USGS maps and a list of priority wetlands that is maintained by EPA, IDFG, and the Idaho Natural Heritage Program. While wetlands are protected by the Clean Water Act, Idaho does not have specific water quality standards, guidance, or policies regarding wetland ecosystems. Any potential assessment of a wetland's function would be limited to the narrative water quality standards provisions. DEQ does not have a process for assessing the beneficial uses or determining if water quality standards are met in wetland habitats. Until DEQ develops bioassessment methods to evaluate the overall ecological conditions of wetlands, an assessor may potentially link a wetlands habitat function to impacts and beneficial use support of associated AUs.

2.1.5 Man-Made Waterways

Man-made waterways are canals, flumes, ditches, wasteways, drains, laterals, and/or associated features constructed for the purpose of water conveyance. DEQ does not currently have a process for assessing the beneficial uses or determining if water quality standards are met in man-made waterways.

2.1.6 Perennial Rivers and Streams

This document guides assessors on how to use monitoring data to determine beneficial use support primarily for lotic water bodies. Rivers and streams are examples of lotic waters with a detectable current and confined within a bed and banks. Rivers and streams are distinguished along a gradient from small headwater tributaries to large rivers. The headwaters of a stream are usually ground-water fed wetlands or springs. Moving downstream, a stream expands in size, accumulating tributaries and draining an increasingly larger catchment area.

DEQ applies different monitoring strategies and assessment protocols depending on whether a water body is a wadeable stream or nonwadeable river. Assessors may encounter data from wadeable streams that flow as a result of precipitation, ground water discharge, surface runoff, and effluent. These different water body types should be assessed on a case-by-case basis to determine if the process detailed in the WBAG is applicable.

The extent or size of a water body represented by a given sample site is important because it affects the quality of assessment results. The basis for extrapolating data ultimately depends on the monitoring design and water body scale. DEQ uses a georeferenced water body identification system as the foundation for extrapolating data results.

2.1.6.1 Determining Water Body Size of Lotic Waters

DEQ uses different monitoring and assessment protocols depending on the size of the flowing water body. Following work done at Idaho State University (ISU) by Royer and Minshall (1999), DEQ showed that for bioassessment purposes, the continuum of Idaho streams from rivulets to great rivers could be stratified into two size classes. DEQ calls these *streams* (small) and *rivers* (large). The size classes have also been referred to as “wadeable” and “nonwadeable,” respectively, but these terms can be vague.

The terms stream and river are used here in a specific technical sense that may differ from their common usage. Through literature review and data analysis, Royer and Minshall (1999) found that three criteria were needed to distinguish between Idaho streams and rivers. A flowing water body is defined as a river when at least two of the following three criteria are met:

1. Order (Strahler 1957, 1:100,000 scale) is 5 or greater.
2. Average wetted width at base flow is at least 15 meters.
3. Average depth at base flow is at least 0.4 meters.

Otherwise, it is a stream.

The ultimate goal of determining water body size should be to ensure the proper monitoring and bioassessment tools are used. If the water body meets the criteria of a river, the assessor should ensure that river monitoring protocols were used and evaluate the data using the appropriate metrics and indices. Any deviations from the above definition should be documented during the assessment process.

2.2 Water Body Identification System

Surface water in Idaho is divided into water bodies and codified in the Idaho water quality standards sections 109–160 based on subbasins (4th-order hydrologic unit codes [HUCs]). The Idaho water body identification system is a georeferenced network of Idaho water bodies based on a combination of two hydrography scales: 1:100,000 and 1:250,000. Water bodies are coded to a 1:250,000 hydrography and named based on a 1:100,000 hydrography. Some water bodies were combined or split based on land use considerations. Canals (unless they follow a natural channel), stock ponds, and tailing ponds are generally not coded in the system. The numbering system is based on USGS hydrologic units, which divide the nation into successively smaller nested units with unique identifiers called hydrologic unit codes (HUCs) and create a national standard for water resources planning and data management.

The USGS hierarchy includes four levels of hydrologic units. The largest are called regions; there are 21 regions in the nation, 18 in the contiguous United States (Figure 1a). Regions are further divided into 221 subregions, 378 accounting units, and 2,264 cataloging units—the smallest element in the hydrologic accounting system. Although all levels are identified by HUCs—codes that range from two to eight digits—Idaho commonly uses the term HUC to describe the eight-digit code of a cataloging unit, or the area of land it represents (often referred to as a subbasin). Unless otherwise specified, when HUC is used in this document it refers to the cataloging unit.

Idaho has 6 basins, which contain 86 HUCs (Figure 1b), 2 of which do not contain any waters of the state. These HUCs represent part or all of a surface drainage basin, a combination of drainage basins, or a distinct hydrologic feature but are commonly referred to as subbasins. Because two of the 86 HUCs that have boundaries within Idaho (HUCs 17010103 [Yaak] and 17060107 [Lower Snake]) do not have water in Idaho, they are not listed in Idaho's water quality standards.

Idaho's water body numbering is based on HUCs. Within each HUC, water bodies are subdivided and numbered with a water body unit in Idaho's "Water Quality Standards" (IDAPA 58.01.02) beginning at the pour point (the furthest downstream point of the water bodies within the HUC) (Figure 1c). Water body units identified in Idaho's water quality standards include all named and unnamed tributaries to the defined water body segment. DEQ further subdivides water bodies into AUs, typically by Strahler stream order, although other factors may be considered (Figure 1d). AUs are discussed in more detail below.

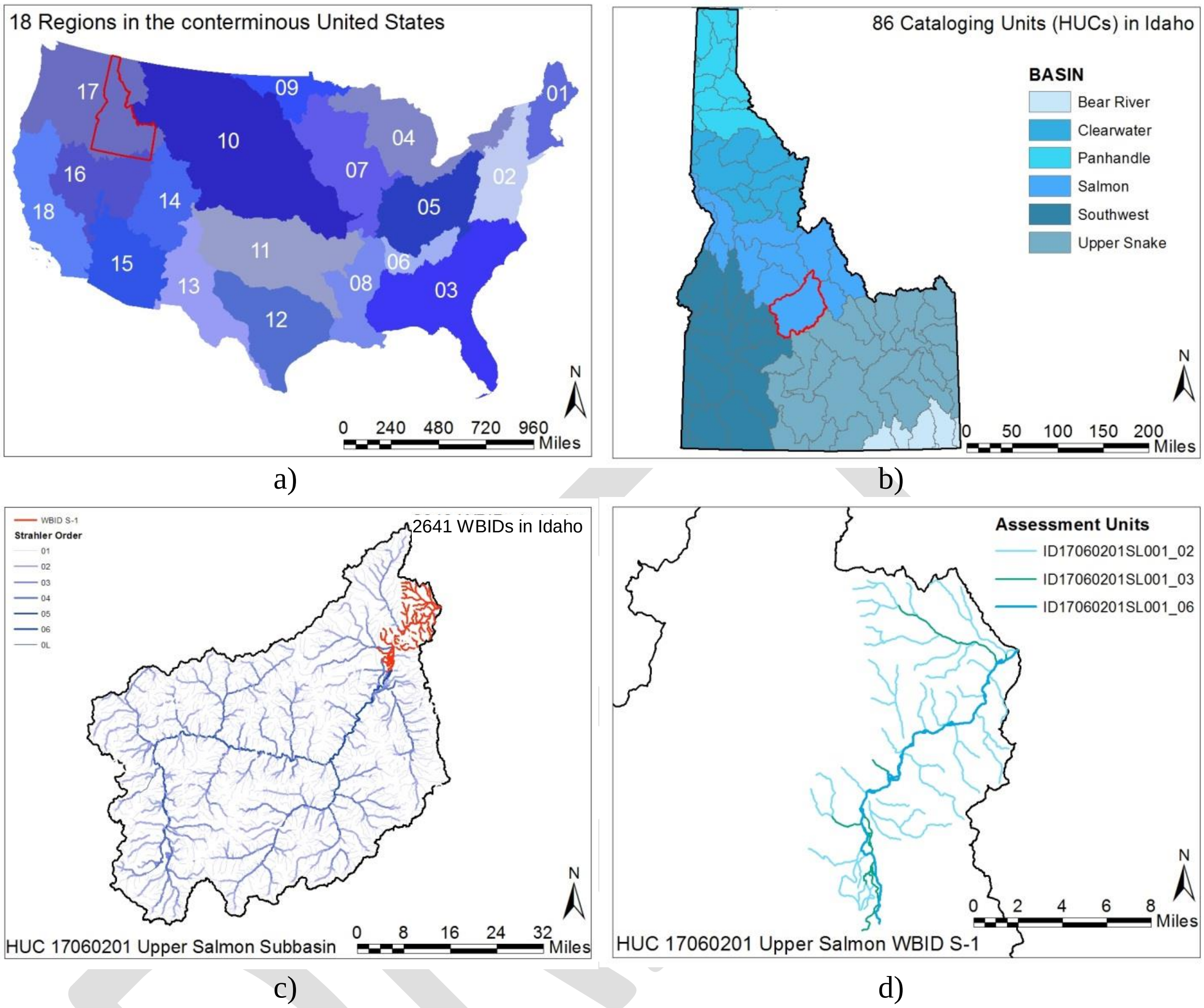

Figure 1. Relationship between hydrologic unit codes (HUCs), water body units, and assessment units (AUs): (a) Level 1 regions in the nation; (b) 86 level 4 HUCs in Idaho (the highlighted HUC is 17060201—Upper Salmon River subbasin in central Idaho); (c) HUC 17060201, Upper Salmon River subbasin, with water body unit S-1 highlighted in red; and (d) water body unit S-1 subdivided into three different AUs.

2.3 Assessment Units

AUs provide an accounting system that guides the assessor in interpreting and extrapolating data for assessment purposes. An AU is a collection of similar waters with similar land use cover, ownership, or land management that is expected to possess similar water quality. The AU also has a systematic numbering system that accounts for all waters in Idaho. This accounting system is based on a stratification of water body units identified in Idaho's water quality standards (IDAPA 58.01.02.109) wherein comparable segments are grouped together. The stratification approach must be refined enough to identify suitable groupings of water bodies for assessment purposes but not so detailed that the number of AUs becomes unmanageable.

DEQ reviewed several types of stratifiers and found the combination of stream order and land use provides sufficient assessment resolution without becoming unwieldy. The stratification is based on the 8-digit HUC using the Strahler method (Strahler 1957) at the 1:100,000 scale to determine stream order. Stream order is used to define comparable stream segments within each water body unit to be treated as an AU and ensure representative monitoring sites. DEQ has combined the 1st- and 2nd-order streams with similar land uses to streamline the stratification procedure since Idaho has over 95,000 miles of river and stream.

DEQ also used GIS information on land use designations and local knowledge in evaluating land uses when segmenting water bodies into AUs. GIS information is from the National Land Cover Database, which includes information regarding developed land, forested areas, and agricultural uses. If additional information is available to warrant an AU being further divided, then DEQ staff may split the AU. AUs may be split due to land use changes or geographical or ecological differences.

Using AUs to describe waters in Idaho offers many benefits, primarily that all waters of the state are now defined consistently. Because AUs are a subset of water body units, they provide a direct reference to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly correlated to streams and lakes on the landscape (IDAPA 58.01.02.110–160).

Each unique AU identification number begins with "ID" for Idaho as part of national reporting, followed by the eight-digit HUC, a two-character abbreviation for the administrative basin, a three-digit number to identify the specific water body unit, then an underscore and the stream order. The two character abbreviation used here for the administrative basin relates to the water body unit designator used in water quality standards. Similarly, the three digit number used in the AU identification number to identify the specific water body unit relates to the single- or double-digit water body unit identifier in the standards (e.g., P-1 becomes PN001). Any AU splits are indicated after the stream order with a lowercase letter (e.g., ID17050114SW005_06a). For an example, see Figure 2. Table 1 provides a crosswalk between the basin designation for water body units identified in Idaho's water quality standards with those used for AUs.

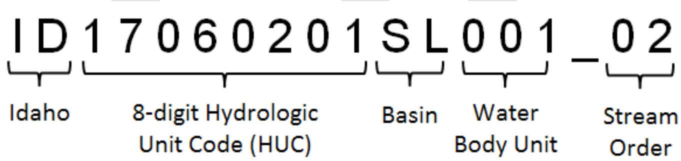

Figure 2. Example of an assessment unit (AU) number.

Table 1. Idaho basin designators in water quality standards (water body unit) and assessment units (AUs).

Water Body Unit Designator	AU Designator	Idaho Basin
P	PN	Panhandle
C	CL	Clearwater
S	SL	Salmon
SW	SW	Southwest
US	SK	Upper Snake
B	BR	Bear

3 Beneficial Use Identification for Assessment

This section describes the beneficial uses of water in Idaho (sections 3.1–3.3) and how to determine the appropriate uses to assess (section 3.4).

Federal regulations implementing the Clean Water Act require states to specify the appropriate uses to be achieved and protected for their waters (40 CFR 131.10). The act requires that, wherever attainable, all waters of the nation be protected for "propagation of fish, shellfish and wildlife" and "recreation in and on the water." This idea is often shortened to the statement that waters must be "fishable and swimmable." These are the minimum set of uses, unless unattainable, along with considering the value of water for public water supply, agricultural and industrial uses, and navigation. States may also adopt subcategories of a use with appropriate criteria to reflect the varying needs of such uses. Collectively these are known as beneficial uses. Beneficial uses are protected by water quality criteria, discussed in section 5. Beneficial uses can be: (1) designated in Idaho's water quality standards, (2) existing uses known to occur in a water body, or (3) presumed uses (in the absence of a designation).

Beneficial uses in the Idaho water quality standards (IDAPA 58.01.02) are described in section 100 and are listed in Table 2.

Table 2. Idaho beneficial uses of water for Clean Water Act purposes (from IDAPA 58.01.02.100).

Beneficial Use Category	Subcategory	Water Quality Standards Abbreviation
Aquatic Life		
	Cold water	COLD
	Salmonid spawning[a]	SS
	Seasonal cold water	SC
	Warm water	WARM
	Modified	MOD
Recreation		
	Primary contact	PCR
	Secondary contact	SCR
Water Supply		
	Domestic	DWS
	Agricultural[b]	—
	Industrial[b]	—
Wildlife Habitats[b]	—	—
Aesthetics[b]	—	—

[a] Although SS is a separate subcategory of aquatic life use, it is treated as a subcategory of COLD.
[b] These uses are designated for all Idaho water bodies.

Aquatic life, recreation, and water supply uses all have subcategories of uses as shown in Table 2. The four main subcategories of aquatic life (COLD, SC, WARM, MOD) are mutually exclusive—only one can apply to a given water body.

Salmonid spawning (SS) is considered a subcategory of coldwater aquatic life (COLD), adding a more restrictive criteria for waters where and when that use applies. Unlike the other subcategories of aquatic life uses, SS carries all of the criteria associated with COLD, with the addition of more stringent criteria. Therefore, if COLD criteria are exceeded, SS criteria must also be exceeded, regardless of the cause of exceedance. However, the inverse is not true: exceedance of SS criteria does not indicate an exceedance of COLD criteria, and therefore do not result in a listing for COLD.

Salmonid spawning is generally considered a more protective subcategory of cold water aquatic life and is listed under "Cold Water" in the use-specific criteria in section 250 of the water quality standards. Salmonid spawning may occur in water bodies with COLD use designations and is not limited simply to those waters designated for spawning. However, it is important to understand that salmonid spawning is a seasonal use and does not occur in the absence of a broader aquatic life use. Salmonid spawning merely adds a seasonal layer of more protective criteria to the aquatic life use.

Two special cases—Bull Trout and Kootenai River sturgeon—are not described in section 100 and are not listed in the use designation tables in sections 110–160. However, they are subcategories of cold water aquatic life that have their own temperature criteria listed in section 250.02.g and 250.02.h of the water quality standards. These temperature criteria are the only other criteria that differ from those for cold water aquatic life. The Bull Trout and Kootenai River sturgeon temperature criteria only apply to waters specified in the rule.

Primary contact recreation is much like salmonid spawning in that it simply adds a layer of protection to secondary contact recreation.

The remaining uses can all apply to the same water body, and often do. All water bodies have multiple uses.

Except for salmonid spawning, Bull Trout, and Kootenai River sturgeon uses—whose protections apply only during certain time periods—uses and their criteria are applied year-round, although there may be time periods when compliance with criteria is most critical. Many pollutants exhibit strong seasonal variation (e.g., temperature, bacteria) and are of greatest concern during a smaller timeframe. Data should be evaluated for compliance during these critical stages to ensure beneficial uses are protected when criteria are most likely to be exceeded.

3.1 Designated Uses

Uses are designated in sections 110 to 160 of the water quality standards. Agricultural and industrial water supply, wildlife habitats, and aesthetics are designated for all surface waters of the state. Designated uses are established by rule; changing them requires rulemaking initiated by DEQ or the Board of Environmental Quality.

> Designated uses are established by rule; changing them requires rulemaking initiated by DEQ or the Board of Environmental Quality.

Designated uses are assigned to the water body unit and apply to all water within a water body unit—they do not vary by AU within a water body unit. To determine the designated uses for an AU, it is necessary to first determine which water body unit the AU belongs to.

> Use designations are by water body unit and apply to all water in a water body unit—they do not vary by assessment unit within a water body unit.

In addition to designated uses, water bodies may also have existing uses and/or presumed use protections that need to be assessed. These are discussed below.

3.2 Existing Uses

Existing uses are defined as those uses actually attained in the water body on or after November 28, 1975. Existing uses in a water body must be protected regardless of whether the water body has been designated for those uses.

This section describes how to determine if cold water aquatic life, salmonid spawning, contact recreation, and domestic water supply uses exist. Because cold water aquatic life is the most stringent use, and because the vast majority of Idaho's waters are believed to support cold water aquatic life, this section does not detail determination of existing uses for seasonal cold, warm, or modified aquatic life.

3.2.1 Cold Water Aquatic Life

Most Idaho waters have cold water aquatic life as an existing aquatic life use. Coldwater species such as trout, salmon, and cold-water obligate macroinvertebrates exist in most Idaho waters and are the organisms that the cold water aquatic life beneficial use criteria were developed to protect. In an effort to reflect the temperature patterns of natural waters across a gradient of very cold to warmer water as they progress from the mountains toward the oceans, the aquatic life use designations include four main subcategories (listed in Table 2).

This section focuses on assessing whether cold water aquatic life uses exist; existing use determinations of seasonal cold, warm water, or modified aquatic life uses are not described here. The following sections describe several lines of evidence to determine whether the cold water aquatic life use is an existing use (summarized in Figure 3). Evaluating these lines of evidence includes comparing taxa from the site to lists of empirically derived or literature-derived macroinvertebrate and fish coldwater indicator taxa. It also requires evaluating the fishery classification. Temperature data gathered over an extended period of time using data loggers may be used as an additional line of evidence to support cold water aquatic life as an existing use but should not be the sole determination of cold water aquatic life as an existing use.

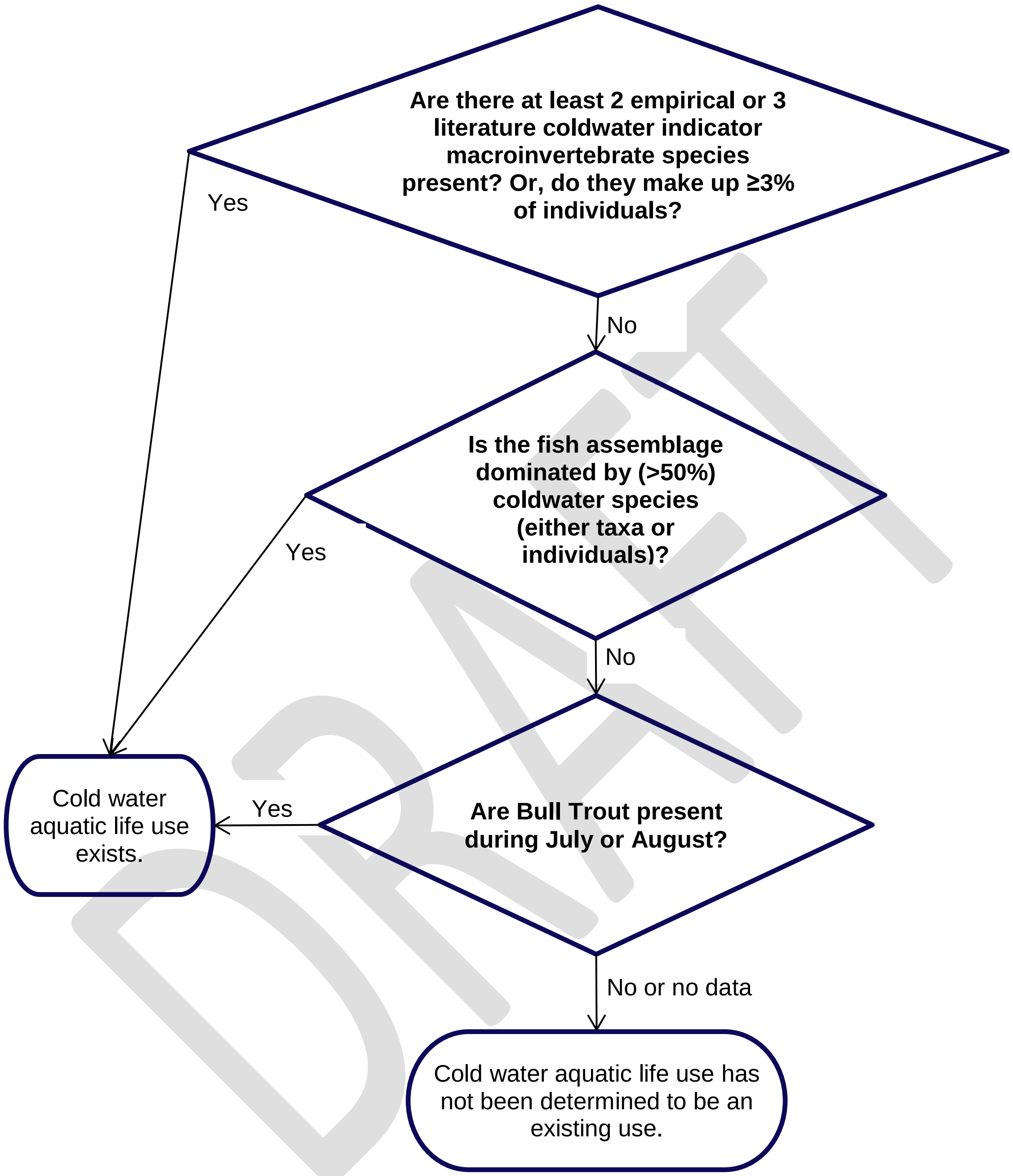

Figure 3. Cold water aquatic life existing use determination for undesignated waters.

3.2.1.1 Macroinvertebrate Coldwater Indicator Taxa

Benthic macroinvertebrates are the preferred indicator fauna of existing cold water aquatic life use because they have either limited migration patterns or a sessile (attached) form of life. These characteristics make them well suited for evaluating local environmental conditions. Some macroinvertebrate species only reside in streams with cold temperatures. If these species are present, the stream likely has consistently cold temperatures. Lists of macroinvertebrate cold water indicator species have been developed from two sources: (1) empirical relationships between species occurrence and temperatures found in an analysis of Beneficial Use Reconnaissance Program (BURP) data (Appendix A) and (2) a review of published literature reports (Appendix B).

An empirically derived list of coldwater indicator taxa was derived by analyzing temperature and species co-occurrence (Richards et al. 2013; Appendix A). To identify obligate coldwater taxa found in Idaho streams, the temperature data and macroinvertebrate communities of more than 6,000 BURP sampling locations were analyzed.

Two criteria were used to identify macroinvertebrates as coldwater indicators: (1) taxa that had their 75th percentile of occurrence below 13 °C, the mean temperature within the data set, and (2) taxa that had their 90th percentile of occurrence at temperatures below 20 °C. These criteria resulted in 59 coldwater obligate taxa that commonly occur in Idaho stream samples (Richards et al. 2013; Appendix A).

From 2000 through 2013, at least two taxa from the empirically derived coldwater taxa list were collected at 77% of sites where stream temperatures were less than 19 °C (the maximum daily average criterion for cold water aquatic life) at the time macroinvertebrate samples were taken. Thus, for assessment purposes, DEQ assumes that cold water aquatic life is an existing beneficial use for undesignated streams when at least two taxa from the empirically derived list of coldwater macroinvertebrate indicator taxa are present (Figure 3).

> Cold water aquatic life is an existing beneficial use for undesignated streams when at least 2 taxa from the ***empirically derived*** list of cold water macroinvertebrate indicator taxa are present.

In a separate effort, a list of coldwater indicator taxa was derived from published accounts of thermal requirements for some Idaho benthic macroinvertebrates by Lester and Robinson (2000). This list is summarized in Appendix B. Similar to the empirically derived list, the literature-derived list of coldwater macroinvertebrates was compared with stream temperatures to provide a basis for assuming a cold water existing use for undesignated streams. In total, 56 stations that were part of a USGS-DEQ monitoring partnership were selected as representative of the major drainages of Idaho. This partnership created a network that resulted in continuous temperature records and macroinvertebrate samples from the same locations (O'Dell et al. 1998). Monitoring results (Maret et al. 2001) were reviewed to estimate the number and percentages of the literature-derived list of coldwater indicator taxa likely at sites where summer stream temperatures met cold water aquatic life criteria.

> Cold water aquatic life is an existing beneficial use for undesignated streams if at least 3 ***literature-derived*** coldwater taxa are present in a sample, or if at least 3% of the entire sample consists of ***literature-derived*** coldwater indicator taxa.

At sites where summer temperatures never exceeded the maximum cold water aquatic life temperature criterion, 0–6 cold water indicator taxa were collected (average of 1.4) and 0–9% of macroinvertebrates (average of 1.0%) were listed as coldwater taxa. From this comparison, DEQ determined, using the literature-derived coldwater taxa list, if at least 3 cold water taxa are present in a sample, or if at least 3% of the entire sample consists of coldwater indicator taxa, that cold water aquatic life is an existing use and should be protected (Figure 3).

3.2.1.2 Fish Coldwater Indicator Taxa

Fish species observed at a site may indicate if cold water aquatic life should be considered an existing use for a water body. Fish are less desirable for this purpose than macroinvertebrates because of their motility. However, since there are far fewer species of fish than aquatic macroinvertebrates and they have been comparatively well studied, the literature on thermal requirements of fish is much more complete than that for invertebrates. Cold water aquatic life should be considered an existing use if the fish assemblage at a site is dominated by coldwater adapted species in the summer. “Dominated by” means that at least 50% of the species present or of individual fish in a summer sample are classified as coldwater species. A listing of fish species temperature classifications is in Appendix C.

The dominance test is needed because the mere presence of coldwater adapted species is usually insufficient to determine a cold water aquatic life existing use. Since both cold- and cool-water species may occur in a water body that is considered to be a seasonal cold water body, using the dominance test ensures that the water body truly is coldwater dominant rather than seasonally cold. The 50% threshold is supported by analyses in the 2002 stream and river fish index technical reports (Grafe 2002a, 2002b). Among reference sites, the median percentage of coldwater individuals in forest streams was 100%; for rangeland streams and rivers, the median percentage of cold water individuals was greater than 50%.

> Cold water aquatic life is an existing beneficial use for undesignated streams when at least 50% of the fish species present or of the individuals in a summer sample are classified as cold water species.

> Cold water aquatic life is an existing beneficial use for undesignated streams if the presence of an individual bull trout during July or August is documented.

One fish species, Bull Trout, is highly stenothermal (i.e., found only in cold waters). Three independent analyses of large data sets showed that Bull Trout are unlikely to be found in the wild at temperatures greater than 19 °C (Rieman and Chandler 1999; and Dunham and Chandler 2001). For assessment purposes, DEQ assumes that cold water aquatic life is an existing use for undesignated streams if the presence of an individual Bull Trout during July or August is documented (Figure 3).

3.2.1.3 Fishery Management Objectives

A further source of information for determining if cold water aquatic life is the appropriate existing use for undesignated waters is the *Fisheries Management Plan* (IDFG 2007). This plan provides information on management goals, species present, and desired management direction (e.g., habitat maintenance and protection needs) for many waters of the state. Where available, the *Fisheries Management Plan* and other reports of the IDFG may be used to document an existing use or as supporting information for determinations. IDFG considers native sport fish (native salmonids and sturgeon) to be the primary fish species to be protected through its management. However, where habitat conditions are unsuitable for native sport fish (e.g., because of river-to-reservoir conversions or other factors) and to provide diverse fishing opportunities, some waters are managed for warmwater fisheries. The aquatic life use classifications and fisheries management type classifications should generally correspond, as shown in Table 3, but may not correspond exactly. For example, some waters managed by IDFG for mixed fisheries may still be designated for cold water aquatic life use. However, waters managed for a cold-water or anadromous fishery should not be assessed for warm water aquatic life.

Table 3. Comparison of Idaho Department of Environmental Quality and Idaho Department of Fish and Game management terms.

Likely Aquatic Life Beneficial Use	Fisheries Management Classification
Cold water	Cold water or anadromous fishery
Seasonal cold water	Mixed fishery
Warm water	Warm water fishery

While conflicting use determinations should be reviewed in consultation with IDFG and resolved, revisions to use designations are beyond the scope of water body assessment.

3.2.2 Salmonid Spawning

Waters that provide or could provide habitat for selfpropagating populations of salmonid species are to be protected for salmonid spawning (IDAPA 58.01.02.100.01.b). Salmonid species include members of the family Salmonidae, specifically trout, salmon, char, and whitefish.

Salmonid spawning begins with egg laying and ends with fry emergence from the gravel. The time periods when criteria specific to salmonid spawning apply are average beginning and end dates, particular to a location, for spawning activity (see section 5.2.4).

To determine whether salmonid spawning is an existing use, the assessor can consider internal and external sources of data and is encouraged to solicit input from technical experts such as fisheries biologists with IDFG or other agencies.

Evidence of salmonid reproduction (e.g., observation of redds [fish nests] or spawning activity) is considered evidence that the waters provide habitat for salmonid spawning. Summertime presence of juvenile salmonids (i.e., individuals less than 100 millimeters overall length) in 1st- through 4th-order streams may be considered sufficient evidence that salmonid spawning has occurred in the near vicinity based on the expectation that juvenile fish stay close to their birth location (Chapman and Bjorn 1969). In that case, salmonid spawning may be considered an existing use for assessment purposes in the portions of the AU for which the site is representative.

> Salmonid spawning may be considered an existing use in the portions of the 1st- through 4th-order streams that an individual site represents if juveniles (individuals less than 100 millimeters long) are present in the summertime.

Nearby streams of the same order to those with observed spawning activity and with similar physical characteristics (e.g., substrate, depth, velocity, and temperature [Bjornn and Reiser 1991]) should also be protected for salmonid spawning since it is reasonable to assume they could provide spawning habitat.

The presence of juvenile salmonids in *streams* is considered indicative of nearby spawning; however, juveniles may move downstream from natal streams into larger waters after hatching (Bjornn and Reiser 1991). Thus, the presence of juvenile salmonids in a *river* may not necessarily indicate the fish hatched there. Before considering salmonid spawning to be an existing use for a larger stream or river (greater than 4th order) based on presence alone, additional evidence is needed such as presence of suitable habitat characteristics (e.g., substrate, depth, velocity, and temperature—see Bjornn and Reiser 1991) or actual observations of spawning.

In 2012, DEQ contracted with BioAnalysts Inc. to identify the timing and location of salmonid spawning and incubation across Idaho. BioAnalysts gathered literature reports and DEQ and IDFG biological data on presence of redds and young-of-the-year and applied NOAA's intrinsic habitat potential to include streams that were not previously identified. Based on known and probable locations of spawning, they created a GIS layer documenting the potential spawning distribution for several species of native and nonnative salmonids. Currently, this report (BioAnalysts 2014) represents the most comprehensive and best available knowledge of when and where salmonids are spawning in Idaho. They also developed regionalized incubation/emergence periods for 21 species.

While this report is not intended to supplant local knowledge, it does provide a systematic statewide view of potential salmonid spawning habitat. It is recommended that this report and associated GIS layer serve as a starting point for determining salmonid spawning in any given water body. This report can be relied on in absence of local knowledge but should be augmented and revised by local knowledge whenever possible.

3.2.3 Recreation Uses

Recreation use includes activities that take place in or on the water, such as swimming, wading, boating, and fishing. Idaho has two subcategories of recreational uses: primary contact and secondary contact recreation. Primary contact recreation (PCR) describes activities where ingestion of water is likely or expected, such as swimming, water skiing, or diving. Secondary contact recreation (SCR) refers to activities where ingestion of water is unlikely or unexpected, such as boating, wading, or fishing. Waters used or suitable for PCR are also suitable for SCR activities such as fishing; however, PCR would be considered the existing use assigned to that water since it is the more protective use.

> Actual observation or other documentation (e.g., photograph, testimony) of primary contact recreation activities on or after November 28, 1975, indicates PCR is an existing use.

Any observation, personal or otherwise documented (e.g., photograph or written record), on or after November 28, 1975, of activities involving full immersion (e.g., swimming, diving, water skiing) would mean that PCR is an existing use. Similarly, observations or documentation of activities associated with SCR occurring on or after November 18, 1975, would mean that SCR is an existing use.

Although the contact recreation criterion is the same regardless of whether the use is PCR or SCR, it is important to identify which threshold to apply to trigger additional monitoring (see Section 7). In the absence of observations or other documentation, the opportunity for immersion is vital in distinguishing PCR from SCR as an existing use. Full immersion in water requires it to be sufficiently deep. Generally, a depth of at least 2 feet will indicate that ingestion of water during swimming or other PCR activities is possible and the assessor should determine that PCR is an existing use. Most standing water, such as a pond, lake, or reservoir, will exceed this depth and should be assumed to provide PCR, unless actual depth measurements show otherwise. In flowing waters, the water velocity, pool depth, and availability of safe entry and exit must be considered. PCR is an existing use if conditions conducive to full immersion in the water body occur between May and September.

> Absent actual observation, primary contact recreation is an existing use if conditions that are conducive to full immersion in the water body exist from May through September.

When assigning PCR or SCR as an existing use in cases without observations or documentation, assessors should provide a rationale or justification that clearly outlines the decision process used in assigning PCR or SCR. Examples of this justification are found in section 3.4.

3.2.4 Domestic Water Supply Use

Industrial and agricultural water supply uses are designated for all waters of Idaho. Thus the existing use question for water supply is only whether domestic use also exists.

To determine whether domestic water supply is an existing use, gather relevant information such as domestic water rights and locations of public and community water systems. Water rights information can be obtained from the Idaho Department of Water Resources (IDWR database of water rights that is searchable online *www.idwr.idaho.gov/apps/ExtSearch/WRAJSearch/SearchPage*). When searching, restrict the search "by source" to *surface water*, by "water use" to *domestic*, and by "type" to *water right*. Restricting the search as much as possible by location is also helpful. On the details page of a water right, pay attention to point of diversion—the location where water can be taken for use. If a surface water right exists for domestic use, then domestic water supply is an existing use.

> If a surface water right exists for domestic use, then domestic water supply is an existing use.

In addition, any observation or other documentation (e.g., photograph, testimony) of domestic use on or after November 28, 1975, shows that domestic water supply is an existing use that needs to be protected.

3.3 Presumed Use Protections

Waters that do not have uses designated in IDAPA 58.01.02.110–160 (i.e., lack *both* an aquatic life and recreational use designation) are considered undesignated waters. For undesignated waters that are not man-made waterways or private waters, Idaho rules state the following:

> Undesignated waters shall be **protected** for beneficial uses, which includes all recreational use in and on the water and the protection and propagation of fish, shellfish, and wildlife, wherever attainable… Because the Department presumes **most** waters in the state will support cold water aquatic life and primary or secondary contact recreation beneficial uses, **the Department will apply cold water aquatic life and primary or secondary contact recreation criteria to undesignated waters** unless Section 101.01.b and 101.01.c are followed." (IDAPA 58.01.02.101.01, emphasis added)

Because of the "fishable and swimmable" requirement of the Clean Water Act, Idaho water quality standards apply cold water aquatic life and recreational use protections as presumed use protections to any water (except man-made or private waters) that is not designated for aquatic life or recreation or is not found to have existing recreation uses. Thus, barring a use attainability analysis that rules out any form of recreational use, all such waters are protected for recreation.

Barring a use attainability analysis, all waters of the state are protected for recreation use.

Because the water quality criterion is the same, for assessment purposes, presumption of PCR over SCR makes no difference (see section 3.2.3). If the assessor has determined there are no designated beneficial uses and the data to determine existing uses is insufficient or incomplete, DEQ will apply presumed use protection in accordance with the water quality standards quoted above.

Use support determination procedures (outlined in sections 6 and 7) for cold water aquatic life and contact recreation, including numeric criteria, apply to undesignated, perennial waters to protect these presumptive uses. If an undesignated surface water body is intermittent (i.e., has zero flow at some time during most years), then aquatic community indices cannot be applied; however, numeric criteria do apply to intermittent waters during periods of "optimum" flow (see IDAPA 58.01.02.010.54, .02.070.06). Narrative criteria always apply to intermittent waters.

Salmonid spawning is never a presumed use protection.

There is no mention of salmonid spawning in the rule language regarding presumed use protection; therefore, salmonid spawning is never a presumed use, and should only be assessed if it is a designated or existing use.

3.4 Determining Beneficial Uses for Assessment

The assessor must determine which aquatic life, contact recreation, and water supply uses should be assessed. Begin by evaluating which uses are *designated* for the water body unit that contains the AU. If there are no designated uses, the assessor should review what data are available on *existing* uses in the AU and make a determination whether cold water aquatic life, either primary or secondary contact recreation, and domestic water supply are existing uses. If insufficient information is available to determine the existing uses, the assessor can apply cold water aquatic life and contact recreation *presumed* use protections.

For example, AU ID17040207SK001_02 encompasses unnamed tributaries to the Blackfoot River in the most downstream section of the river before it enters American Falls Reservoir. The water quality standards indicate this water is designated for secondary contact recreation only; there is no entry for aquatic life, which means it is undesignated for that use (at IDAPA 58.01.02.150.09). The next step would be to determine if sufficient data exist to determine the existing aquatic life use. No biological or temperature data have been collected in this AU. The IDFG *Fisheries Management Plan* (IDFG 2007) shows that the river and tributaries in the area are managed for a coldwater fishery. In addition, the management plan also discusses historical information that would indicate these tributaries did attain cold water aquatic life uses at some point since 1975. Therefore, cold water aquatic life should be evaluated as an existing use. In this case, there is no need to apply the presumed use protections.

Another example is AU ID17060308CL019_03. This stream is identified in the water quality standards as Foehl Creek - source to mouth (water body unit C-19 at IDAPA 58.01.02.120.10). This AU has no designated uses and must be evaluated for existing uses. One BURP site is located near the mouth of the creek. The macroinvertebrate data show 8 obligate coldwater taxa (literature-derived list) and 12 obligate coldwater taxa (empirically derived). In addition, the percent of coldwater fish in the sample was 100%. Both lines of evidence indicate that cold water aquatic life is an existing use for this AU. No data are available to determine if contact recreation is an existing use, so the protection of contact recreation is presumed. The average depth of the stream is 0.95 feet with pool depths ranging from 3 to 4 feet. Access to this stream is by horse or backpacking with no roads nearby. The pool depths exceed the 2-foot guideline for full immersion and this water may possibly be used for bathing and swimming. So for this AU, the assessor would assess cold water aquatic life as an existing use and PCR trigger value as presumed.

Domestic water supply is a beneficial use that is either designated or found to be existing (as outlined in section 3.2.4); otherwise, the AU should not be assessed for domestic water supply.

Industrial and agricultural water supply, wildlife habitats, and aesthetic beneficial uses apply to all surface waters of the state and are considered to be supported if the general water quality criteria listed in IDAPA 58.01.02.200 are met.

4 Monitoring Design and Data Policy

DEQ collects data from various sources and receives data from external parties. This section discusses the monitoring programs DEQ participates in and how DEQ ensures external data are used for appropriate purposes based on the scientific rigor and relevance of those data.

4.1 Monitoring Programs

DEQ addresses its monitoring needs through implementing and participating in several programs. DEQ's primary ambient monitoring program is the Beneficial Use Reconnaissance Program (BURP). However, DEQ is also a partner in the US Environmental Protection Agency's (EPA's) National Aquatic Resource Surveys (NARS), which generate tier 1 data that can be directly integrated into assessments (see section 4.2 regarding data tiering and use). DEQ also routinely performs supplemental, parameter-specific monitoring that may be used to make assessment decisions.

In general, DEQ monitors water bodies based on assessment priorities. Although DEQ may use data collected from other sources, the WBAG is primarily designed to assess data collected under BURP and EPA's NARS.

The following sections highlight the major components of DEQ's ambient monitoring program. A full discussion of DEQ's ambient monitoring strategy is available in the *Surface Water Ambient Monitoring Plan* (DEQ 2012).

4.1.1 Beneficial Use Reconnaissance Program

In 1993, DEQ implemented BURP, which is an ambient monitoring program that integrates biological and chemical monitoring with physical habitat assessment as a way of characterizing water quality (McIntyre 1993). BURP provides consistent ambient data for beneficial use support assessments. The program closely follows concepts and methods described in EPA's *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (Barbour et al. 1999).

BURP mainly addresses small streams and, to a lesser extent, large rivers. BURP efforts have focused primarily on wadeable streams; however, monitoring protocols and assessment methodologies for nonwadeable rivers have been developed and have had limited implementation. BURP protocols are only applicable to perennial waters. Efforts to develop standard monitoring and assessment methodologies for lakes and reservoirs have been considered and remain a focus of the ambient monitoring plan.

The overall process for collecting and managing BURP data is shown in Figure 4. DEQ publishes an annual BURP work plan for statewide use by DEQ field crews and other entities. Six regional BURP coordinators train and direct crews in each of the DEQ regional offices, while state office staff coordinates among the regions and audit crews to ensure consistent monitoring practices. BURP monitoring occurs from July 1 through September 30 and addresses three specific questions:

1. What is the overall condition of all Idaho waters?
2. What are the water quality expectations for Idaho waters?
3. What is the condition of particular water bodies of interest?

DEQ determines the condition of all Idaho waters by implementing a probabilistic monitoring survey, which allows for estimates of the condition of all Idaho waters by sampling water bodies throughout the state. DEQ has produced statewide assessments of ecological condition of lakes (Kosterman 2010), nonwadeable rivers (Kosterman et al. 2008; Pappani 2010), and wadeable streams (Kosterman et al. 2008; DEQ 2013). DEQ continues to integrate probabilistic monitoring surveys into its BURP monitoring strategy.

DEQ identifies the expectations for Idaho waters and monitors trends in water quality through monitoring at reference/trend sites. These sites are selected to reflect conditions with minimal human impacts. Monitoring occurs annually or on a rotating basis. Results are compared across years to determine temporal variability.

DEQ determines the condition of particular water bodies of interest through targeted monitoring. Priorities for targeted monitoring are set by the individual regional offices. In general, targeted monitoring focuses on acquiring sufficient data to make listing or delisting decisions on waters where existing data are insufficient or outdated.

All BURP data are electronically entered and stored in a centralized database at the state office. Data for each sample site are recorded on standard electronic field forms. Regional offices perform data validation prior to submitting data electronically to the central database (Figure 4). DEQ does not store or manage external data in the centralized database, but does maintain records of data and reports submitted from external sources.

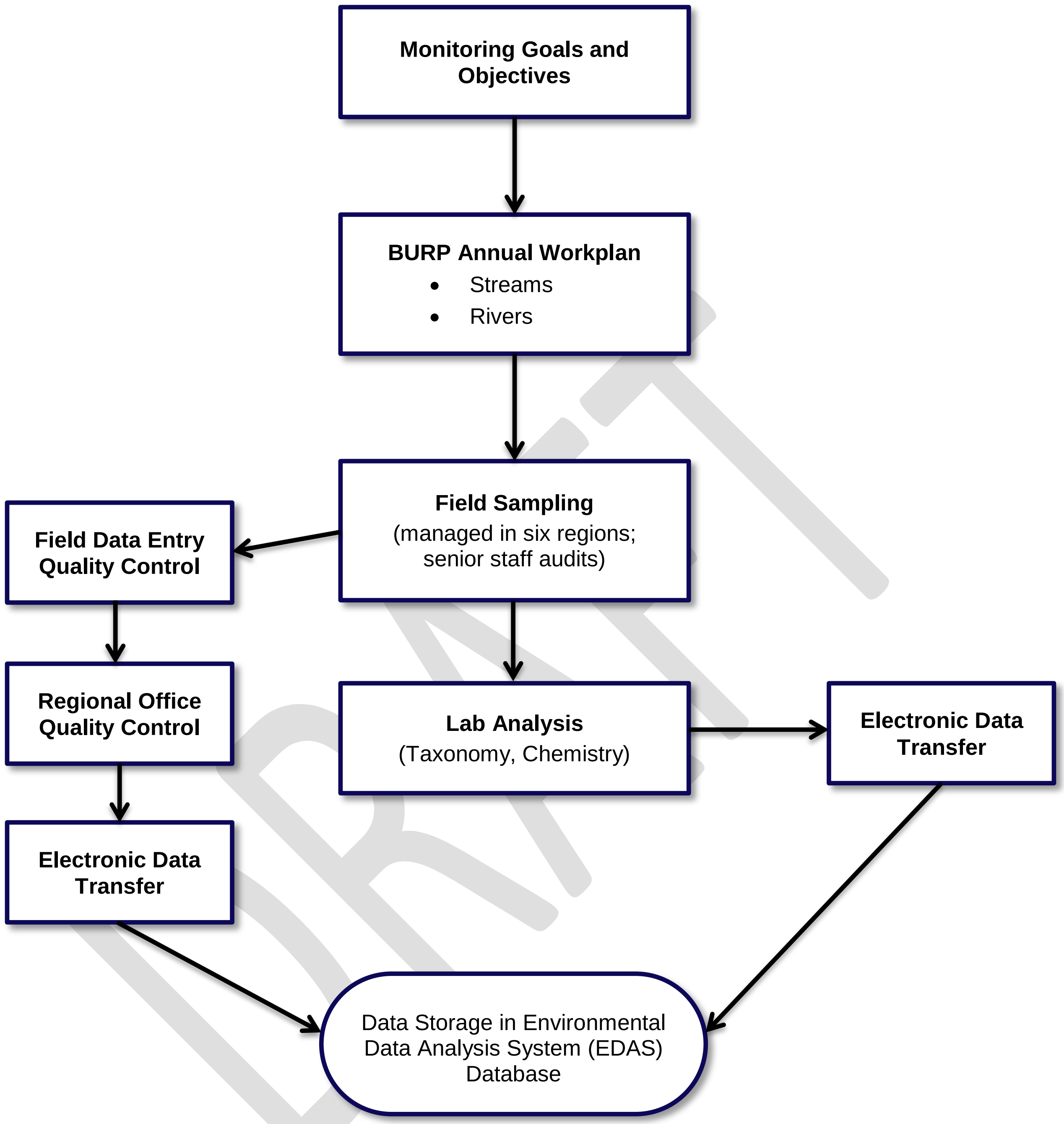

Figure 4. Monitoring and data management overview.

4.1.2 National Aquatic Resource Surveys

DEQ also participates in EPA's NARS, formerly the Environmental Monitoring and Assessment Program, or EMAP, which provide national reports on the condition of water bodies using standardized protocols and probabilistic survey designs. NARS monitoring occurs on a 5-year rotation by resource type (Table 4).

Table 4. Schedule of National Aquatic Resource Surveys, 2011–2020, by resource type.

Resource Type	Survey Activities by Year				
	2011/2016	2012/2017	2013/2018	2014/2019	2015/2020
Wetlands	Monitor	Analyze Data	Report	Research	Design
Lakes	Design	Monitor	Analyze Data	Report	Research
Rivers	Research	Design	Monitor	Analyze Data	Report
Streams	Report	Research	Design	Monitor	Analyze Data
Coastal[a]	—	—	—	—	—

[a] Idaho does not participate in the coastal surveys.

Each resource type is monitored every 5 years under the NARS rotation. Intervening years are dedicated to data analysis, drafting and publishing a report of the findings, research and development of existing and new methodologies, and survey design and logistics.

NARS data are used to supplement BURP probabilistic survey data for determining the condition of Idaho waters (e.g., Kosterman et al. 2008; Kosterman 2010). In addition, NARS data can be used to inform listing and delisting decisions on specific water bodies.

4.1.3 Supplemental Monitoring

In addition to the above integrated ambient monitoring programs, DEQ also routinely monitors waters for chemical, physical, and biological parameters in response to public interest or complaints, in support of TMDLs and subbasin assessments, or to generate data sufficient to make assessment decisions. Parameters monitored by DEQ staff often include nutrients (e.g., nitrogen and phosphorus), toxics (e.g., selenium and arsenic), streambank erosion, temperature, and bacteria (i.e., *Escherichia coli*).

4.2 Existing and Readily Available Data Policy

Data are the foundation of DEQ's assessment process. Although the WBAG was designed primarily to assess DEQ BURP data, DEQ also considers other existing and readily available data from both internal and external sources during the assessment process.

The data used in the assessment process may be from other agencies, institutions, commercial interests, interest groups, or individuals and may relate to the existence, support status, or associated criteria for the beneficial uses in a water body. For example, EPA NARS reports the ecological condition of water bodies throughout the nation. The conclusions of these condition assessments are sufficient for making listing and delisting decisions.

This section explains how DEQ classifies data as tier 1, 2, or 3, and how those data are used in water quality decisions. Only tier 1 data are used in §303(d) listing and delisting decisions, but tier 2 or 3 are used in other water quality decisions requiring assessment information.

DEQ will use *external* tier 1 BURP-compatible data in the multimetric index process described here. If tier 1 data are not BURP compatible or are not in an electronic format, they will not be run through the multimetric indices but may be used to determine numeric criteria exceedances (section 5) or beneficial use support determinations (section 6 and 7), depending on their form as explained below. Figure 5 shows how non-DEQ (i.e., external) data can be used in DEQ's water body assessment process.

To obtain outside data, DEQ publicizes a request for data and solicits data from appropriate sources for water bodies targeted for assessment. An example of a DEQ data request letter is shown in Figure 6.

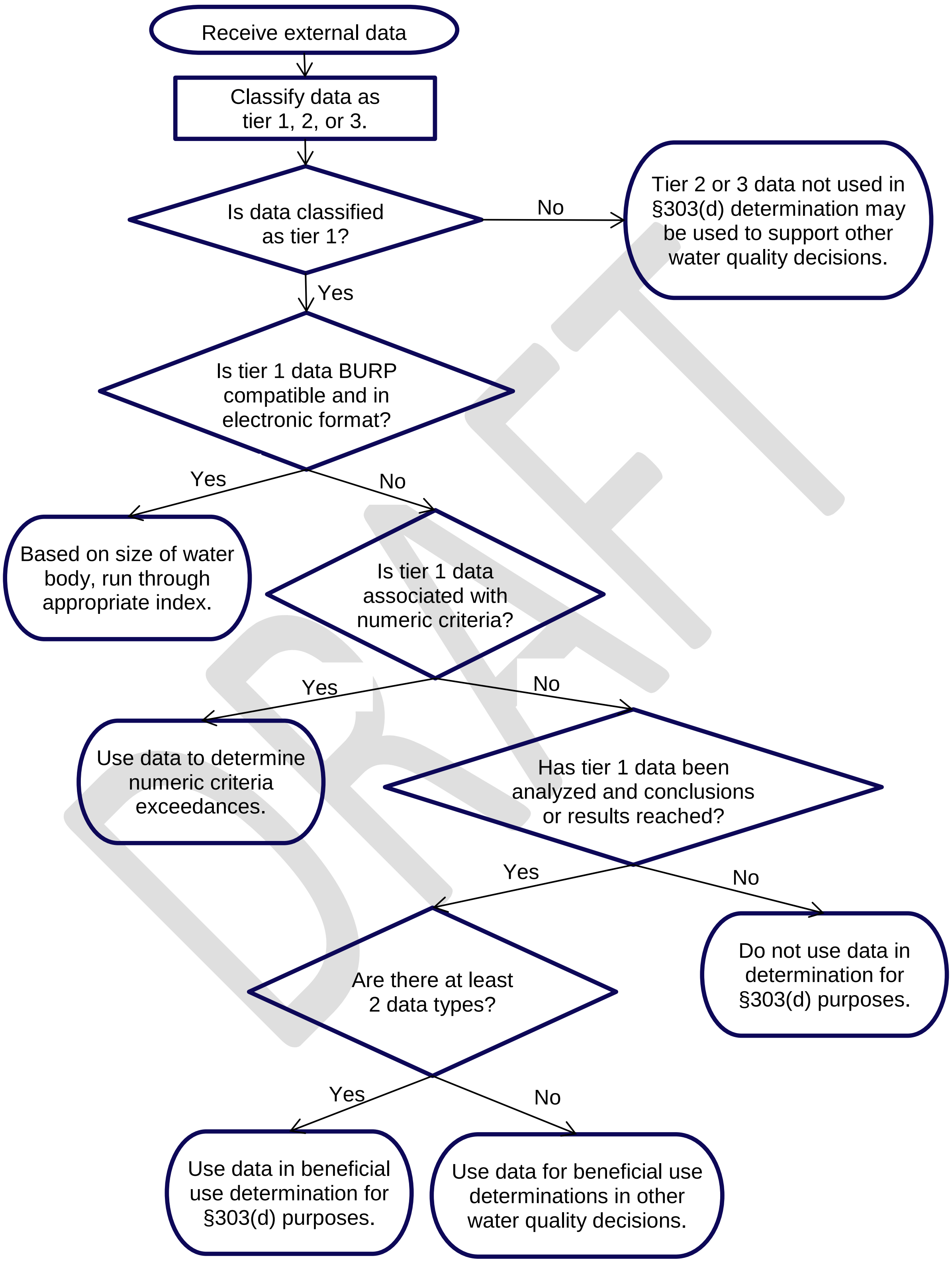

Figure 5. How external data are used in the water body assessment process.

July 1, 2000

John Smith
U.S. Forest Service
123 State Street
Anywhere, Idaho 12345

Dear Mr. Smith:

The Boise Regional Office of the Idaho Department of Environmental Quality (DEQ) will be assessing the water quality beneficial uses of Deep Creek within your management area. Beneficial uses include aquatic life, salmonid spawning, contact recreation, agricultural water supply, domestic water supply, industrial water supply, wildlife, and aesthetics. DEQ will evaluate the beneficial uses for monitored water bodies using the DEQ Water Body Assessment Guidance. We are requesting data from you to help with this effort.

Specifically, the following types of data and information would be helpful:

- water column chemistry data (e.g., dissolved oxygen, ammonia, phosphorous, metals, etc.);
- physical data (e.g., temperature, riparian proper functioning condition, cumulative watershed effects, etc.);
- biological or bioassessment data (e.g., macroinvertebrate, fisheries, periphyton, etc.); and
- land use data including location, size, and types of specific land uses.

When providing us with collected data, please also furnish information about the quality assurance and quality control procedures used. We will review the data and information. Data less than five years old and in computer readable format is particularly helpful. The furnished data may be used for a variety of purposes including comprehensive state water quality assessments [305(b) reports], water quality impairment lists [303(d) lists], and total maximum daily loads (TMDLs). Thank you in advance for your help with this effort. If you have already supplied us with the requested data, then please disregard this inquiry.

Sincerely,

Jane Doe
Regional Water Quality Assessor

Figure 6. Example DEQ data request letter.

4.2.1 How Data Are Evaluated: A Tiered Approach

DEQ evaluates existing and readily available data from external sources. *Evaluate* means to consider submitted data for use in beneficial use support determinations. Specifically, DEQ evaluates the scientific rigor and relevance of non-BURP-compatible data to determine where and how it will be incorporated into the assessment process and other water quality decisions

(EPA 1997). Tier 1 numeric data that relate to specific water quality criteria are evaluated according to the criterion evaluation and exceedance policy described in section 5.

Other types of data may be used to affirm or change a use support determination based on their scientific rigor and relevance and significance to the assessment process. DEQ uses a tiered approach to provide consistent weighting and consideration of various types of data. Initial aquatic life support status assessments may be confirmed or modified based on other available information (see section 6). Table 5 summarizes the three tiers and provides examples of different data types in each tier. The table also describes how DEQ uses different tiered data for planning and reporting purposes.

For discussion on what types of data are used for other decisions, refer to the *Idaho Antidegradation Implementation Procedures [draft]* (2012).

Table 5. Description, examples, and incorporation of data tiers.

Tier	Scientific Rigor	Relevance	Example	How Used
1	• Quantitative • Parameters measured • Established monitoring plan with QA and defined protocols • Appropriate supervised training for samplers • Samples processed in EPA-certified lab following standard methods or by professional taxonomist • Organisms identified by a professional taxonomist	• Data relates to either water quality standards, especially numeric, beneficial uses, or causes of impairment • ≤5 years old • Data relates to a named water body (GIS location, latitude and longitude, or map location provided) and are representative	• PhD or master's thesis • Published or printed studies or reports • Published predictive models • EPA NARS • BURP data • Use attainability analyses • Rapid Bioassessment Protocols (RBP)	• §303(d) listing or delisting • §305(b) reports • Subbasin assessments • TMDLs • Planning for future monitoring
2	• Qualitative or semiquantitative • May have a monitoring plan • No QA/QC provided for within monitoring plan • Protocols may or may not be defined • Parameters rated • Field staff may not be trained; lab may not be certified • Taxonomist may not be a professional	• Data may relate to a watershed • Not water body–specific • Data >5 years old • Data may relate to other agency guidelines or objectives	• Environmental assessments • Proper functioning condition assessments • Most citizen monitoring • Models with documentation • Agency planning documents	• §305(b) reports • Subbasin assessments or TMDLs when data adds to overall assessment quality • Planning for future monitoring
3	• May be qualitative in nature • Parameters evaluated • Field staff have little to no training • No documented monitoring plan • No QA/QC • Anecdotal in nature	• Not specific to water quality standards or beneficial uses • Location not specific • Data ≥10 years old	• Nonspecific reports or studies • Newspaper articles • Simple models without any documentation	• Planning for future monitoring • Hold for further investigations

4.2.1.1 Scientific Rigor

Scientific rigor concerns the extent that scientific methods are used to collect and analyze data. It encompasses quality assurance, quality control, training, level of expertise, and protocols. DEQ categorizes data into three tiers of scientific rigor with more weight given to data with a higher level of scientific rigor (Table 5).

4.2.1.2 Data Relevance

Data must be relevant and scientifically rigorous to be incorporated into the assessment process. To determine relevance, DEQ applies a two-part test:

1. Data must relate to a water quality standard, beneficial use, or cause of impairment.
2. Data must be tied geographically to a particular site on a particular water body. Location information such as latitude and longitude (GPS), a specific map, or public land survey system (i.e., township, range, section, and quarter) description must accompany the data.

4.2.2 Tier Descriptions

The scientific rigor and relevance of data are evaluated together to determine the appropriate data tier and therefore the appropriate use for the data.

4.2.2.1 Tier 1

Data must meet both scientific rigor and relevance of tier 1 criteria to be classified at the tier 1 level. See Appendix D for a checklist to use in classifying tier 1 data. The scientific rigor of tier 1 data is characterized as high and typically includes monitored data collected by professional scientists or professionally trained technicians with appropriate supervised training. The data are collected and analyzed under a monitoring plan with quality assurance and parameters measured. Samples are processed in an EPA-certified lab following standard methods or by a professional taxonomist. Biological data may come from one of several different assemblages—such as macroinvertebrates, fish, or algae—and are identified by a professional taxonomist. Physical habitat data may have quantitative measurements and standardized qualitative assessment procedures.

To be considered relevant, tier 1 data usually include direct measurements or observations of beneficial uses, criteria, or causes of impairment. In addition, the sampling must be representative. To be considered representative, data must have been collected at multiple times and locations or at a location that is shown to be representative of the water body as a whole. The information must be 5 years old or newer and must be able to be differentiated along a gradient of environmental conditions (EPA 2000). Predictive models must include calibration factors and are not to be used exclusively to make beneficial use determinations.

Examples of tier 1 data include data from BURP, EPA NARS, Rapid Bioassessment Protocols, use attainability analyses, graduate theses, and professional and peer-reviewed studies, reports, or predictive models. These data can come from a number of possible sources such as state and federal agencies, academic institutions, local governments, or private parties. Tier 1 data are of sufficient quality and relevance to be used for Clean Water Act §303(d) listing and delisting decisions, §305(b) reports, subbasin assessments, and TMDL development (Table 5).

4.2.2.2 Tier 2

DEQ characterizes the scientific rigor of tier 2 data as qualitative or semiquantitative. The data collectors must have followed documented field, laboratory, and data-handling protocols; must have rated parameters; and may have a monitoring plan. The monitoring plan may or may not provide quality assurance (QA) or quality control (QC) information. Tier 2 data include professional evaluations and habitat data consisting primarily of standardized visual assessments of evaluations. However, some field staff may not be trained, the evaluating laboratory may not be certified, or a professional taxonomist may not have identified the samples.

Relevant tier 2 data may include evaluations based on monitored or evaluated data more than 5 years old, watershed land use information, modeling results with estimated inputs, or measurements of an atypical event (EPA 2000). Data may be watershed- rather than water body–specific. They may also relate to guidelines or objectives of other government entities.

Examples of tier 2 data include data collected for environmental assessments, proper functioning condition (PFC) assessments, and agency planning documents as well as citizen volunteer monitoring data. Tier 2 data are not used in §303(d) listing decisions due to higher data requirements for impairment decisions under §303. However, tier 2 data may be used in subbasin assessments and TMDLs when the assessor has the time to consider these data in context with other collected information. These data can also be used to establish applicable beneficial uses for assessments and in §305(b) reports (Table 5).

4.2.2.3 Tier 3

The scientific rigor of tier 3 data often includes information collected by unknown or untrained individuals. The data may not have been collected or analyzed following standard or reported protocols. Data without any originating documentation also appears in this category.

Relevance is limited due to data having no intrinsic judgment or known reference for comparison. The data may have been extrapolated based on other sites or be a reflection of a specific localized condition not representative of the water body. This type of information may be considered as general background information, but it is not of sufficient rigor and relevance for listing decisions or regulatory actions. Tier 3 data are not used in §303(d) decisions or §305(b) reports due to the uncertainty in their scientific rigor and relevance to beneficial uses or water quality standards. These data may be used in helping DEQ target future planning and monitoring (Table 5).

4.2.3 How Tier 1 Data are Used in Beneficial Use Support Determinations

Data are used for different water quality decisions depending on their tier. As noted above, only certain tier 1 data are used in making §303(d) listing or delisting decisions. As shown in Figure 5, the format of the tier 1 data determines its use. This section describes how DEQ uses different forms of tier 1 data.

4.2.3.1 External BURP-Compatible Data

DEQ characterizes BURP-compatible data as having similar protocols to those used in BURP (Table 6). DEQ treats BURP-compatible data equally with regards to the data integration methods described in section 6. If DEQ receives BURP-compatible data in an electronic format for a water body, the data will be incorporated directly into the appropriate assessment index and the results used to determine water body status. BURP-compatible data are collected in the same manner as DEQ data. All the multimetric indices DEQ uses were developed using BURP-compatible data. Consequently, BURP compatible data are necessary to correctly calculate and apply the various biological and habitat indices used in assessing aquatic life (see section 6). Index outputs can then be directly compared to one another. Using non-BURP-compatible data introduces variability and bias brought on by different sampling equipment, locations, or times that may invalidate the comparison (EPA 1997).

Table 6. BURP-compatible data requirements.

Parameter or Assemblage	Requirements to be Considered BURP Compatible
Macroinvertebrates	Quantitative sampler, sampled in riffles, 500 micrometer mesh sampler, collected during July 1–October 15, and insects identified to lowest possible taxonomic level
Fish	Fish assemblage sampled with a battery- or gas-powered electrofisher, over 100 meters of stream sampled, effort recorded, fish identified, species counted, and lengths of salmonids and cottids recorded
Algae	Quantitative sampler, collected from natural substrate in riffle habitat, and minimum of 800 valves enumerated to lowest possible taxonomic level for diatoms
Habitat	Minimum of the following 10 habitat parameters sampled—some are rated (r) while others are measured (m): instream cover (r), large organic debris (m), percent fines <2 millimeters (m), embeddedness (r), number of Wolman size categories (m), channel shape (r), bank vegetation (m), canopy cover (m), disruptive pressures (r), and zone of influence (r)

If the tier 1 data are BURP compatible (see Table 6) and are in electronic form, they are used in the appropriate multimetric index calculations and the results are used to determine the status of the water body for §303(d) purposes. A minimum of two different indices are required for data integration and determining aquatic life use support (see section 6). The requirement of two or more different indices does not supersede the minimum threshold policy for macroinvertebrates or fish as discussed in section 6.

4.2.3.2 Data Associated with Numeric Criteria

If tier 1 data are associated with numeric criteria but not in electronic format, DEQ will assess these data according to the criteria exceedance policies described in section 5. A single data type can be used to determine numeric criteria exceedances. Data type is defined as one set of particular data. For example, one set of temperature results from continuous data loggers (i.e., thermographs) is considered one data type. DEQ prefers tier 1 data be submitted in electronic form and accompanied by analysis and conclusions. However, DEQ will accept raw data and perform analysis for numeric criteria exceedances.

4.2.4 Non-BURP-Compatible Data

If data are not BURP-compatible, their use in the assessment process depends on whether they were submitted with accompanying data analysis and conclusions and how many data types were included.

4.2.4.1 Data Analysis and Conclusions

If the data are not associated with numeric criteria, DEQ then ascertains if the data have been analyzed and if conclusions or results were reached. If this information does not accompany the data, then DEQ will not use these data for §303(d) listing or delisting determinations. This policy only pertains to data not associated with numeric criteria and is based on two important considerations. First, DEQ is concerned about the error rate associated with analyzing someone else's data for listing or delisting decisions. Second, time and resource constraints prohibit DEQ from adequately analyzing outside data during the §303(d) assessment process. For beneficial use support determinations in other water quality decisions, DEQ evaluates the use of unanalyzed data based on the time and resources required and available.

4.2.4.2 Number of Data Types

If data are accompanied by results, then DEQ evaluates the number of data types. DEQ policy is to use a minimum of two data types to make listing or delisting decisions. These data types can be physical (e.g., sediment) or biological (e.g., macroinvertebrates). Also, the weight of evidence from these data types should convincingly refute or support the beneficial use support determination.

A single data type not associated with numeric criteria may be incorporated into other water quality decisions but cannot be used solely for §303(d) listing or delisting decisions.

4.3 Justifying Determinations based on Available Data

Although the assessment process is designed to be comprehensive and accurate in determining impairment status of beneficial uses, there may be times when data indicate conflicting results. Throughout this guidance, DEQ repeatedly states that the assessor has the latitude to change an assessment determination with sound justification. Another situation where the assessor may need to provide justification occurs when using only non-BURP-compatible data types.

Sound justification or documentation entails providing convincing evidence for an initial support determination or reconciliation of conflicting data results. The DEQ guidance for this evidence is slightly different depending on the support determination.

If the assessor believes the determination should be not supporting, then the justification should demonstrate all of the following:

1. Data show measurable and adverse change to the beneficial use.
2. The adverse change is linked to a causative pollutant.
3. The pollutant is linked to a human-caused action.

If the support determination is believed to be full support, then the assessor should demonstrate one of the following:

1. Weight of evidence convincingly shows no measurable adverse change to the beneficial use.
2. Data convincingly show that an adverse change is not due to a causative pollutant.
3. Data convincingly show that the pollutant is not linked to a human-caused action.

5 Water Quality Criteria Evaluation and Exceedance Policy

Under the Clean Water Act, setting water quality standards is a state responsibility, subject to EPA oversight. Federal policy allows states flexibility in interpreting the standards they develop. Idaho water quality standards lay out narrative and numeric criteria to protect beneficial uses. The suite of criteria appropriate to protecting a use varies by use subcategories. These subcategories do not necessarily change all criteria; they may change only one or a few. For example, the only difference between primary and secondary contact recreation is in the *E. coli* threshold values used to trigger additional monitoring; all the toxics criteria remain the same. Similarly, the primary difference in the various aquatic life uses is in their temperature criteria. This section provides interpretive guidance on certain aspects of both narrative and numeric criteria.

Narrative criteria are sometimes called “free from” criteria as they often contain statements such as “water shall be free from toxics in toxic amounts” and have no quantitative thresholds set in rule. Narrative criteria require an assessor to make a case-by-case evaluation of whether the criteria are met. Guidance for this evaluation is provided below.

Numeric criteria, on the other hand, set quantitative thresholds that apply broadly. While these are much easier to evaluate, the simple “one-size-fits-all” approach does not always mesh with the natural variability of water bodies. With the goal of protecting beneficial uses, Idaho’s water quality rules and exceedance policy described in this section provide for limited flexibility in determining when exceedance of numeric thresholds indicates a water body does not support beneficial uses or is a violation of water quality standards.

This section describes narrative and numeric criteria evaluation, including help in applying the narrative criteria for nutrients and sediment and information about numeric criteria, such as a 10% criteria exceedance policy for certain commonly monitored pollutants, Idaho’s hot weather temperature exemption, allowance for natural background conditions for all pollutants, guidance on determining when and where salmonid spawning occurs for the purpose of applying salmonid spawning criteria, and evaluation of toxics criteria.

5.1 Narrative Criteria Evaluation Policy

Narrative criteria protect against impairment of beneficial uses by pollutants that do not have numeric criteria. The Idaho water quality standards generally state that surface water shall be free from the following materials in concentrations that would result in impairment of beneficial uses (see IDAPA 58.01.02.200):

- Hazardous materials
- Toxic substances
- Deleterious materials
- Radioactive materials
- Floating, suspended, or submerged matter
- Excess nutrients
- Oxygen-demanding materials
- Sediment

DEQ largely relies on its biological metrics to evaluate narrative criteria for aquatic life uses (see section 6) and determine whether a water body is impaired. At times, however, DEQ is presented with data, such as ambient water quality sediment or nutrient data, which suggests a violation of narrative criteria and therefore an indication that the water body should be listed as impaired. In addition, even if DEQ has used BURP data to determine impairment, in the development of the integrated report or in a subbasin assessment, DEQ will also have to determine the cause of that impairment—what pollutant has caused the impairment. Associating an impairment with a pollutant also determines whether a narrative criteria is violated. For example, if it is determined that the impairment is caused by excess sediment, the water quality will necessarily violate the narrative sediment criteria that prohibits levels of sediment that impair uses.

However, there can be clear evidence of narrative criteria violations in absence of BURP data. For example, a water body may have reports of fish or cattle mortality from drinking water containing toxic algae. In this example, beneficial uses are clearly impaired, even though no numeric criteria are exceeded.

In the absence of numeric criteria, the assessor must use substantiated best professional judgment to determine whether narrative criteria have been exceeded. If the assessor determines impairment has occurred as a result of a certain pollutant, through violation of the narrative criteria, he or she must provide a documented rationale for such judgment. . **This documentation must describe a source of pollution (i.e., anthropogenic cause), a pathway for pollution to reach the water body, and a measurable adverse effect on a beneficial use.** To the extent possible, appropriate data should be collected to substantiate such determinations.

> Documentation of narrative criteria exceedances must show a source of pollution, a pathway for pollution to reach the water body, and a measurable adverse effect on a beneficial use.

Most often, assessors are faced with evaluating Idaho's narrative criteria for nutrients and sediment, which have no single number that determines impairment of beneficial uses. These pollutants are particularly difficult because they are natural constituents of water and only become problems when elevated above natural background and beyond the water body's assimilative capacity. It is only when an excess exists due to anthropogenic impacts that DEQ should determine nutrients or sediment are impairing the beneficial uses of a water body and are a cause for listing a water body.

Taking sediment, for example, and applying the guidance of the previous paragraph, there must be an anthropogenic source of sediment, such as a road or mass failure attributable to a road or sediment due to a land management activity. Secondly, there must be a pathway for that source to deliver sediment to the water body by current delivery (e.g., mass failure runout ending in a stream channel) or recent delivery (e.g., delta or sediment deposits in stream directly traceable to a source). Finally, that sediment delivery must be of sufficient quantity and duration to have an adverse effect on a beneficial use in the stream. This effect is most defensible when the response is directly measurable as an undesirable change in the aquatic life of the stream (e.g., measurable changes in sediment intolerant macroinvertebrate assemblages or fish mortality). Information obtained through BURP monitoring data, as well as other appropriate internal and external data sources, can be used to make these determinations.

It may also be possible to use physical characteristics of the stream that are generally associated with adverse biological changes to infer a likely adverse effect on a beneficial use (e.g., excessive percent fines). This linkage is a difficult association and must be done on a watershed-specific basis (for example, see Bauer and Ralph 1999). Such inferences should be followed up with bioassessment.

The following steps should help in determining if nutrient and sediment are causing impairment. First, determine if the water body is impaired, either from past assessments or currently available data. Typically a water body will be listed for combined biota/habitat bioassessment if the aquatic life use is impaired and further analysis would lead to the conclusion that nutrients or sediment are causing the impairment. The WBAG requires three things be present to make a determination of impairment due to a narrative criterion: (1) a source of pollution, (2) a pathway, and (3) a measurable adverse effect on a beneficial use.

If nutrients or sediment are suspected of impairing the beneficial uses of a water body, other parameters should be investigated. The following are examples of parameters that would be expected to indicate nutrient or sediment impairment:

- For nutrients—concentrations of chlorophyll *a*, total phosphorus, total nitrogen, ash-free dry mass, and dissolved oxygen
- For sediment—percent fines, depth fines, bank recession/stability, turbidity, total suspended solids, and the macroinvertebrate fine sediment index

If nutrients are suspected, the assessor should have *at least* two of the parameters listed above. If using chlorophyll *a*, total phosphorus, or total nitrogen, the assessor can compare the results to TMDL targets, EPA gold book values (EPA 1986), EPA §304(a) recommendations, or other published values to determine if impairment exists for these parameters. If using dissolved oxygen, sags in diel oxygen concentrations can be used as a surrogate measure to determine a nutrient impairment. However, DEQ recommends that other corroborating evidence be present to back up this conclusion. If the water was initially listed for combined biota, this evidence may often be present in the subbasin assessment.

If sediment is suspected, the assessor should have *at least* two of the parameters listed above, or other appropriate physical or biological data with scientific justification. Results can be compared to TMDL targets, model results, or other published values to determine impairment due to sediment.

5.2 Numeric Criteria Evaluation Policy

Water quality conditions vary spatially (from place to place) and temporally (from time to time) due to variation in geology, vegetation, elevation, climate, and natural or ambient water quality (EPA 2000). In response to these changes, macroinvertebrates, fish, and algae have evolved with different life histories, physiologies, and motilities (Pan et al. 2000). Most surface waters and aquatic organisms can tolerate or adapt to small exceedances over short time periods for some water quality parameters (DO, pH, turbidity, temperature) without adverse effects (Cairns Jr. 1977; Connell 1978). This concept is embedded in the theories of resistance and resiliency, chronic versus acute effects, and the buffering capacity of running waters (Wetzel 1983; Allan 1995).

Due to natural variability in water quality, variability in translation to a biological response, and possible measurement errors, DEQ does not interpret the numeric criteria for DO, pH, turbidity, and temperature as a sharp line between impairment and nonimpairment but rather as a gray zone where an impairment may be possible. Because criteria are developed conservatively, DEQ believes this gray zone can fall above the set criteria levels.

5.2.1 Frequency of Exceedance Policy for Dissolved Oxygen, pH, Turbidity, and Temperature

The DEQ exceedance policy attempts to better clarify the occurrence and interpretation of these situations. DEQ has adopted this policy in its WQS. IDAPA 58.01.02.054.03 provides that in making use support determinations, DEQ may give less weight to departures from criteria for pH, turbidity, dissolved oxygen, and temperature that are infrequent, brief, and small if aquatic habitat and biological data indicate to the assessor that aquatic life beneficial uses are otherwise supported. "Infrequent" is defined in the rule as less than ten percent of valid, applicable, representative measurements when continuous data are available. This numeric criteria evaluation policy is consistent with guidance from EPA (1997) and other states in EPA Region 10 (WDOE 1997).

> "Unless otherwise determined by DEQ, "infrequent" means less than 10% of valid, applicable, representative measurements when continuous data are available; "brief" means 2 hours or less; and "small" means conditions that avoid acute effects." IDAPA 58.0102.054.03

While this section only addresses frequency of exceedance, as noted above, the WQS also recognize that magnitude and duration of any criteria exceedance is also important to the biological response and should be considered as well. However, magnitude, duration, and frequency are typically related – that is, higher and longer exceedances lead to greater frequency of exceedance as well when regularly spaced (e.g. hourly, daily) measurements are evaluated. Thus, evaluating frequency alone, while it can have its limitations, is a practical gauge of use support and one that is supported by national EPA policy.

This section establishes the guidelines for determining if a particular set of criteria exceedances has resulted in an impairment of water quality. A frequency of exceedance greater than 10% always supports an impairment listing. However, with an exceedance rate less than 10%, DEQ may determine a numeric criteria violation for DO, pH, turbidity, or temperature if other evidence indicates measurable impairment. Note that a single exceedance is always more than 10% if the data represent fewer than 10 regularly spaced 'continuous' measurements. At least two measurements must be evaluated for any of these parameters before a determination of violation can be made. Figure 7 illustrates this process. In using this policy, the assessor must consider the period of measurement. To determine meaningful frequencies, the data record should be representative of the entire period when criteria apply.

> Although we speak of continuous data, in the age of digital recording of data what this means is high frequency regularly spaced measurements, typically at least every hour. If these regularly spaced measurements are two hours or more apart, then even one value above a criterion could indicate a duration of more than 2 hours

Because of the seasonal cycle of temperature, special consideration is necessary for evaluating temperature exceedances. To evaluate salmonid spawning temperature criteria, temperature data should be collected for at least 45 consecutive days during the spawning and incubation period for the particular salmonid species inhabiting the waters of interest. For cold water aquatic life, temperature data should be collected over the entire summer (June 22–September 21). In addition, the frequencies must be calculated on the metric of interest (e.g., the frequency of daily maximum stream temperature exceeding daily maximum criteria). DEQ has prepared a memo on procedures for calculating frequency of exceedance for temperature (Appendix E). Anyone evaluating temperature exceedances should consult this memo.

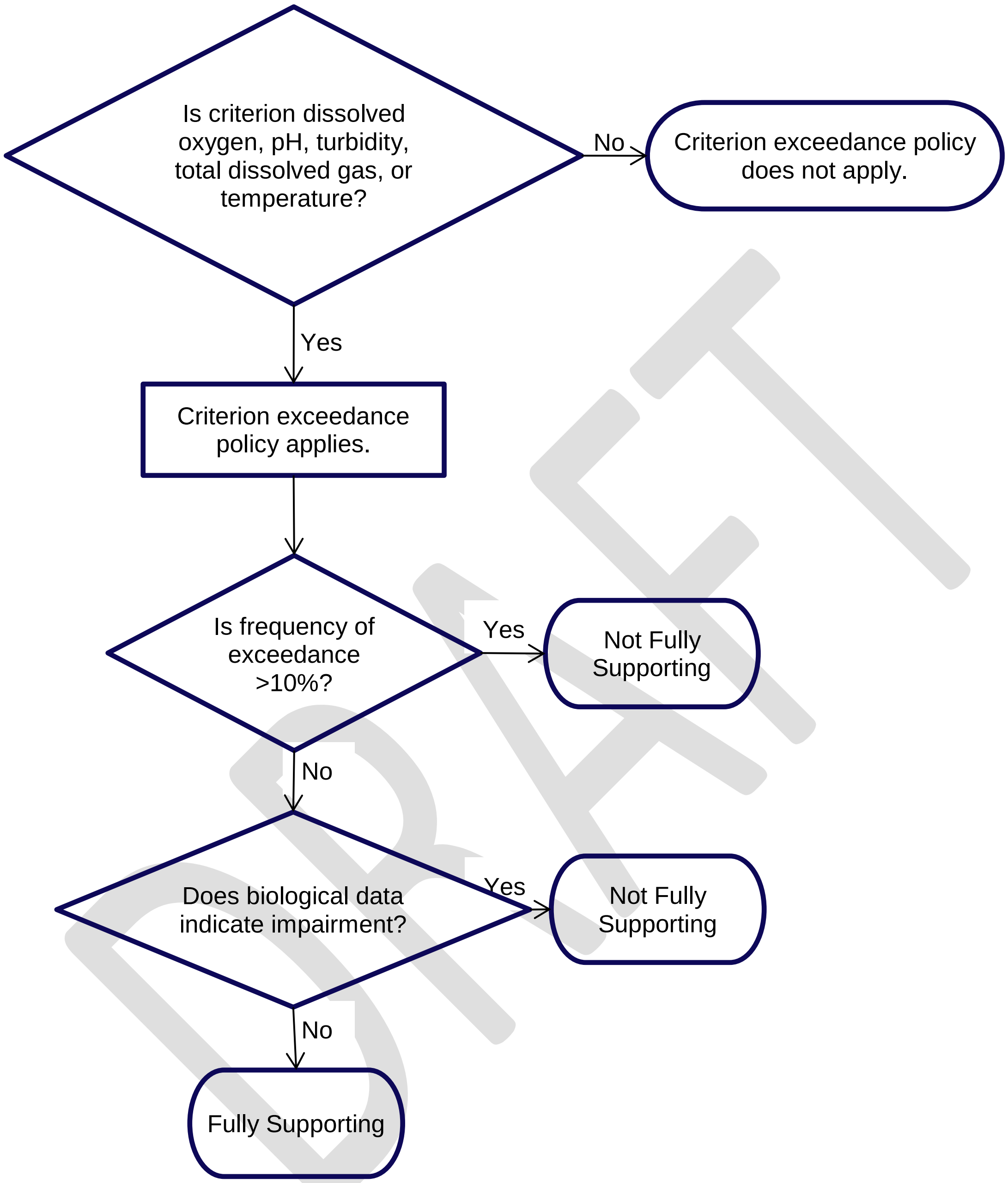

Figure 7. Numeric criterion exceedance evaluation for §303(d) listing.

5.2.2 Temperature Exemption

During hot weather, stream temperatures are expected to rise. In some waters, this increase alone can cause water temperature to exceed criteria. Thus, Idaho and other agencies acknowledge that when the ambient air temperature is extremely high, exceeding water temperature criteria is not a standards violation (IDAPA 58.01.02.080.03; ODEQ 1995; Coutant 1999).

The Idaho water quality standards define air temperature extremes as any time "…the air temperature of a given day exceeds the ninetieth percentile of a yearly series of the maximum weekly maximum air temperature (MWMT) calculated over the historic record measured at the nearest weather reporting station" (IDAPA 58.01.02.080.03). For this reason the Idaho water quality standards exempt the numeric temperature criteria when these conditions are met weather station.

There is only one MWMT per year, and only 1 year in 10, on average, will see the MWMT greater than the 90th percentile value. The exemption is narrow by design and should take effect only rarely, on the hottest days of a warm summer and likely not at all in most years. In practice, DEQ will require a minimum of a 10-year period of record to calculate a 90th percentile for applying this rule.

To simplify applying this exemption, DEQ compiled historic air temperature records for weather stations throughout Idaho with at least 30 years of continuous data (Appendix F). From these records, we determined annual 7-day average maximum air temperatures for each station and calculated the 90th percentile of these annual maximums over the period of record. When these 90th percentile values are exceeded at the representative weather station, temperature criteria in the water quality standards do not apply.

To apply the temperature exemption, follow these procedures:

1. Determine the representative weather station (Appendix F). This should be the weather station that is closest to the site being assessed.
2. Download continuous temperature data from the representative weather station for the time period being assessed.
3. Identify days from the period of interest when the daily maximum exceeds the 90th percentile of the MWMT for the weather station. For these days, ambient water quality criteria for temperature do not apply.

5.2.3 Natural Background Provision

Exceedances of numeric criteria can occur under natural conditions. For instance, many streams and rivers draining wilderness or minimally disturbed watersheds cannot meet Idaho's current temperature criteria (Bugosh 1999). The Idaho water quality standards state that natural background conditions must be considered in criteria evaluations:

> When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, there shall be no lowering of water quality from natural background conditions. (IDAPA 58.01.02.200.09)

Natural background conditions are defined as "the physical, chemical, biological, or radiological conditions existing in a water body without human sources of pollution within the watershed" (IDAPA 58.01.02.010.63).

In evaluating waters for impairment, it is desirable to consider whether natural conditions or human sources are the cause. This distinction is often difficult to sort out and there is often not enough time or data to fully consider causes when conducting statewide assessments for reporting required by Clean Water Act sections 303(d) or 305(b). Therefore, the assessor should assume wilderness and other roadless watersheds to be without human sources of pollution and thus *a priori* at natural background condition. Other watersheds with some human disturbance could be determined to exhibit natural conditions for specific pollutants. A watershed assessment, such as those prepared before a TMDL, is needed for less obvious cases of natural conditions. DEQ has developed more complete and separate guidance on determining natural background conditions (DEQ 2003).

While this provision applies to any parameter, this section specifically addresses temperature. Whether or not the levels of a particular parameter naturally exceed a criterion is a parameter-specific question; thus, it does not require the watershed as a whole be undisturbed or absent of human influences. For example, removal of riparian shade would be expected to raise water temperature but not affect natural metal levels; conversely, a mine in a watershed could raise certain metals above natural levels yet leave stream temperature natural.

Water quality that naturally exceeds criteria can also have an added human influence (i.e., the impaired condition can be due to a combination of both natural and human sources). Such situations do not qualify for delisting or exclusion from Category 5 for natural conditions unless, for temperature, the increment of human impact is less than 0.3 °C. However, once a water body is listed, the natural component in a blended source situation may mean that the target condition for restoration (in a TMDL) is a natural condition warmer than numeric criteria. In other words, the goal is to correct human impacts; thus, a water body that meets natural conditions is fully restored even if not meeting all its applicable numeric criteria.

According to *Concepts and Recommendations for Using the "Natural Conditions" Provisions of the Idaho Water Quality Standards* (DEQ 2003), stream water temperatures may be *a priori* presumed to be natural if the following conditions exist:

For Rangeland-Dominated AUs:

> 1. No riparian roads are present and few road crossings exist; and
>
> 2. No water withdrawals are present; and
>
> 3. No signs are apparent of human-caused, accelerated erosion such as gullies, downcut stream channels, laid back banks, and
>
> 4. No riparian livestock grazing has occurred in the last 10-years; or
>
> 5. If riparian livestock grazing is allowed to occur, <10% of the streambanks have been altered, and
>
> 6. Stubble height or other benchmarks of healthy riparian vegetation do not indicate grazing over-utilization.

(DEQ 2003, p. 25)

For Forestland-Dominated AUs:

> 1. No forest harvest impinges riparian areas (75 foot minimum buffer width); and
>
> 2. No riparian roads are present and few road crossing exist; and
>
> 3. No evidence of sources of sediment delivery that are associated with human disturbance such as gullies originating from culverts, mass failures associated with road fills or timber cuts; and
>
> 4. No water withdrawals are present.

(DEQ 2003, p. 20)

If an AU meets these conditions for its dominant land type, then it should not be placed in Category 5 of the Integrated Report for temperature even if the temperature data exceeds applicable numeric criteria. When determining the appropriate buffer width (75-foot minimum), the setting, vegetation type, and stream size is also considered. DEQ assumes that an AU entirely in designated wilderness or roadless areas meets the above conditions. Other AUs outside such areas can also qualify as having a natural temperature condition, but these require multiple lines of evidence showing that the conditions for *a priori* presumption have been met.

An exception to meeting the conditions for *a priori* presumption would be if a potential natural vegetation (PNV) evaluation (Shumar and De Varona 2009) showed that current shading vegetation is not measurably different from PNV throughout the AU, and other potential sources of heat load—such as channel widening, point sources, or water withdrawals—are absent. In such instances, the temperatures are considered natural.

A PNV evaluation is not required to show a natural condition for temperature, but it provides strong evidence and is highly recommended. A PNV analysis provides the documentation needed to demonstrate natural condition for temperature even when all the *a priori* presumptions are not met. For example, shade may be shown to be at natural potential even though some grazing has occurred in recent years or where old timber harvests have sufficiently recovered. When applying PNV, DEQ pays special attention to natural disturbances that may have removed shade, such as fire. If shading is below PNV due solely to natural disturbance, the situation is still natural.

5.2.4 Salmonid Spawning

Salmonid spawning criteria are a more protective subcategory of the cold water aquatic life use meant to protect spawning for salmonid fishes (IDAPA 58.01.02.250.02.f). In addition to all other cold water aquatic life numeric criteria (see section 6.3), waters for which salmonid spawning is a designated or existing use must meet more specific and stringent criteria concerning temperature, water column dissolved oxygen, and intergravel dissolved oxygen saturation (Table 7). This discussion focuses on timing of application of temperature criteria, although much of it is also relevant to applying dissolved oxygen criteria.

Table 7. Cold water aquatic life criteria dependent on salmonid spawning.

Parameter	Cold Water: *without* Salmonid Spawning	Cold Water: *with* Salmonid Spawning
Temperature	19 °C daily average, 22 °C daily maximum	9 °C daily average, 13 °C daily maximum
Water Column Dissolved Oxygen	6 mg/L minimum	Greater of 6 mg/L or 90% saturation
Intergravel Dissolved Oxygen	None	5 mg/L minimum, 7-day average >6 mg/L

Applying water quality standards to salmonid spawning waters takes special consideration because the time frame of their application is site, species- and spawning/incubation-period specific. The water quality standards read as follows:

> Waters designated for salmonid spawning, in areas used for spawning and during the time spawning and incubation occurs, are not to vary from the following characteristics due to human activities. (IDAPA 58.01.02.250.02.f)

Listing all the possible spawning and incubation periods for different species for different areas is beyond the scope of the water quality standards and this water body assessment guidance. However, in order to apply criteria, the assessor needs to estimate the applicable time periods. Table 8 lists core time periods when salmonid spawning and egg incubation typically occur. These time periods may be used as a guide for when to apply salmonid spawning criteria. If more specific information is desired about time periods for a specific water body or region, assessors are encouraged to use additional available information. The information sources used need to be documented in the assessment process. Sources of information might include articles from fisheries journals, reports, or written records of field observations made by fisheries biologists for the location.

Table 8. Spawning and egg incubation periods for select native and introduced salmonid species in Idaho.

Fish Species	Time Period
Chinook Salmon (spring/summer run)	August 15–June 1
Chinook Salmon (fall run)	October 1–April 15
Sockeye Salmon	October 1–June 1
Steelhead Trout	April 1–July 15
Redband/Rainbow Trout	March 15–July 15
Cutthroat Trout	April 1–July 1
Bull Trout	September 1–April 1
Kokanee Salmon	September 1–May 1
Mountain Whitefish	October 15–March 15
Brown Trout	October 1–April 1
Brook Trout	October 1–June 1

Assessors are encouraged to estimate spawning and incubation periods with a level of detail appropriate for the assessment purpose. For example, if an assessor is screening more than a hundred temperature records for exceedances, the core periods may be sufficient. If an assessor is examining temperature records from a single watershed or subbasin and the precision of the estimates are biologically or economically important, a careful literature and records review, convening an expert panel, or field surveys might be justified. Assessors may use any reasonable and knowledgeable approach for estimating these time periods, as long as the approach is sufficiently documented so that it could be reconstructed. *The Geography and Timing of Salmonid Spawning in Idaho* (BioAnalysts 2014) provides a comprehensive review of when and where salmonid species are spawning in water bodies across Idaho.

Federal and state regulations identify certain water bodies where Bull Trout spawning is to be protected. Temperature criteria for Bull Trout spawning need to be applied to these waters in September and October regardless of local information (IDAPA 58.01.02.250.02.g; 40 CFR 131.33).

Criteria are intended to protect indigenous species; however, the state may also choose to protect introduced species if the state considers them desirable. If an introduced salmonid species is present in a water body and the IDFG considers that species desirable for that drainage, then salmonid spawning criteria would be applied for that species. The management objectives of IDFG's *Fisheries Management Plan* (IDFG 2007) specify, by drainage, which species are considered desirable and are managed for propagation and sustainable populations. Species such as Rainbow Trout have ambiguous origins and occur both as an indigenous species and as a species that has been widely stocked within and beyond its historical range. In these cases, fish are considered indigenous if they are located within the historical range for that species and if they naturally reproduce in the water body. Not all managed fish populations are expected to be selfpropagating (i.e., put-and-take fisheries where catchable fish are stocked each year with little or no expectation of successful reproduction). Where this is the case, cold water aquatic life is a use, but it would be inappropriate to apply salmonid spawning criteria to protect the stocked put-and-take species.

5.2.5 Bacteria

Bacteria, specifically *E. coli*, can be used as indicators of the presence of pathogens in water. The Idaho water quality standards contain *E. coli* criteria to protect human health during contact recreational uses. How the criteria apply depends on the recreational beneficial use of the water body and whether the samples have been collected at a public swimming beach.

The *E. coli* criterion is a geometric mean concentration not to exceed 126 cfu/100 mL (IDAPA 58.01.02.251). The Idaho water quality standards address frequency for *E. coli* criteria exceedances in the primary and secondary contact recreation criteria by using instantaneous values that trigger additional sampling. Additional sampling is required so that a geometric mean can be calculated and compared to criteria to determine a violation.

The current *E. coli* criteria reflect levels that protect swimmers from exposure to water that contains organisms indicating the presence of fecal contamination. Epidemiological studies show greater association between *E. coli* and gastrointestinal illnesses than between fecal coliforms and gastrointestinal illnesses. Therefore, Idaho's water quality standards use *E. coli* as an indicator of human pathogens in surface waters.

The current methodology for determining impairment due to bacteria starts with a single sample analyzed for *E. coli* taken during the summer. The results from this single sample are compared to threshold values depending on the designated or existing recreational uses. Threshold values are used to determine if more intense monitoring is needed. Exceeding the single sample threshold value is not a violation of the bacteria criterion.

> Exceedance of a single *E. coli* threshold value *does not* constitute a violation of the criterion. The criterion can only be applied to a geometric mean of five samples collected over thirty days.

If the single sample exceeds the threshold value of 235 cfu/100 mL at a public swimming beach, 406 cfu/100 mL for waters with primary contact recreation, or 576 cfu/100 mL for waters with secondary contact recreation, additional sampling is required. This additional sampling must include five samples taken within a 30-day period (the first sample may be included if it is within the 30-day period). The samples must be spaced at least 3 but no more than 7 days apart (i.e., cannot take five samples in less than 15 days or more than 30 days).

A five-sample geometric mean is calculated as follows:

$$Geometric\ mean = \sqrt[5]{Sample_1 * Sample_2 * Sample_3 * Sample_4 * Sample_5}$$

Geometric means are commonly used in environmental data as they reduce the influence of very high or very low values, which tend to bias arithmetic means (straight average). The geometric mean is especially helpful when analyzing *E. coli* bacteria concentrations due to the fact that they are highly variable in the environment and levels may vary anywhere from 10 to 10,000 fold over a given time period.

5.2.6 Toxics

Ambient water quality criteria have been established for toxic substances and other chemicals (IDAPA 58.01.02.210, .02.250). These criteria are explicitly defined, which allows for definitive conclusions about compliance. Unfortunately, many of the chemical criteria are complex, with precise sampling, analytical, and quality control requirements. This section highlights some concepts necessary in evaluating outside data to see whether the results show Idaho numeric toxics criteria are exceeded. It does not provide the detail needed to prepare a sampling and analysis plan for surface waters for toxics criteria compliance. The numeric criteria are closely related to the narrative standard prohibiting toxic substances in concentrations that impair beneficial uses (IDAPA 58.01.02.200.02).

Toxic substances and chemical criteria are defined in terms of concentrations and frequency and duration of allowable exceedance of these concentrations. Concentrations are usually defined for maximum and average concentrations, referred to as criterion maximum concentrations (CMC), or “acute” criteria, and criterion continuous concentrations (CCC), or “chronic” criteria. The allowable recurrence interval and durations of exposure vary between the different criteria. CMCs are defined as 1-hour (sometimes 1-day) average concentrations which, if not exceeded more than once every 3 years except possibly when a locally important species is unusually sensitive, should protect aquatic life uses. CCCs are usually defined as 4-day or 30-day average concentrations which, if not exceeded more than once every 3 years, should protect aquatic life uses.

Numeric toxic substances criteria, including their rules on application (frequencies and duration), are listed in IDAPA 58.01.02.210. All criteria listed use the 1-hour and 4-day durations for CMC and CCC, respectively. Ammonia criteria are listed in IDAPA 58.01.02.250.02.d and use 1-hour and 30-day day durations for CMC and CCC, respectively. By definition then, if two or more exceedances of either a CMC or CCC occur less than 3 years apart, the respective criterion is violated. It follows then, that no single exceedance within a 3-year period can be used to judge a numeric toxics criteria violation. However, a single high value might still be determined to be a violation of the narrative toxic substances standards or more likely lead to further investigation.

5.2.6.1 Equations and Questions of Form

The criteria for ammonia and several divalent metals are expressed as equations and require the corresponding water hardness to be known. For ammonia, pH and temperature must be known to calculate a criterion. If concurrent hardness, pH, or temperatures are not reported, the assessor may determine if typical values are known for the water body in question for the time period of interest. If so, the basis for these assumptions must be recorded in the assessment. For example, average summertime hardness might be estimated based on a review of the annual USGS water resource data water year report series.

Some of these criteria equations are fairly complex. Examples for total ammonia as ammonia nitrogen (mg N/L) (when fish early life stages are likely present) and dissolved cadmium criteria, in (µg Cd/L) follow:

$$CCC(ammonia) = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}} \right) \bullet MIN\,(2.85, 1.45 \cdot 10^{0.028(25-T)})$$

$$CCC(cadmium) = 1.101672 - (\ln(hardness) \bullet 0.041838) \bullet e^{[(0.7852 \bullet \ln(\text{hardness}))\text{-}3.490}$$

Spreadsheets to calculate these values given hardness, pH, or temperature are available from the Surface Water Program and are posted on DEQ's website at *www.deq.idaho.gov/water-quality/surface-water/water-quality-criteria*.

While not inclusive, some commonly encountered steps to answering questions of form follow:

Most metals criteria are expressed as "dissolved" concentrations in micrograms per liter (IDAPA 58.01.02.210.03.c.iii). Operationally, "dissolved" metals mean that the samples were filtered (0.45 µm filter) in the field before any preservative was added. Data reported as "total" or "total recoverable" metals cannot be directly compared to the dissolved criteria, and no definitive assessment of violation can be made. However, assessments of compliance can be made. By definition, total metals include dissolved, colloidal, and particulate fractions. If data reported as total metals are less than a dissolved criterion value, the assessor can be confident the true dissolved concentration is lower and thus in compliance. A data report should clearly describe the filtration, preservation, and analyses that were completed. The selenium and chronic mercury criteria are the only metals criteria expressed as total recoverable metals instead of dissolved metals.

Ammonia criteria are specified as total ammonia nitrogen (mg N/L) concentrations (although it is the ionized ammonium that causes toxicity)—pH and temperature relate the two forms. Cyanide is specified as "weak-acid dissociable" (WAD) cyanide. If the data reviewed cannot be related to the respective chemical forms listed in the water quality standards, then no comparison to criteria can be made.

5.2.6.2 Frequency and Duration of Exposure

Since chemical criteria are expressed as "not to be exceeded … more than once in three (3) years," more than one exceedance in a 3-year period is needed to violate a numeric chemical criteria.

However, it is reasonable to conclude that if a *single* valid data point for a toxic substance referenced in IDAPA 58.01.02.210 is greater than two times its CMC, the *narrative* standard for toxics substances has been violated because waters are *not* free from toxic substances in concentrations likely to impair aquatic life beneficial uses (IDAPA 58.01.02.200.02). This inference is possible because of the way CMCs for toxic substances are derived. A final acute value (FAV), which is expected to be lethal to 50% of sensitive species, is divided by two to obtain the CMC (i.e., CMC = FAV/2) (Stephan and others, 1985). This criterion derivation is performed to reduce a lethal concentration to a concentration expected to kill few, if any, organisms. It follows that if a reliably measured concentration is greater than twice the CMC (i.e., is greater than or equal to the FAV), it is likely to be lethal to sensitive organisms used in criterion development. Therefore, the assessor may conclude the water body is unlikely "free from toxics in toxic amounts" even if only one data point is available or only one exceedance in a 3-year period has been documented at twice the CMC.

5.2.6.2.1 Durations for Criterion Maximum Concentrations (Acute)

Most acute criteria are expressed as 1-hour average concentrations. As a practical matter, most surface water chemical data are collected as single grab samples, not as width-integrated composites or multiple grabs within a single hour. If a grab sample is collected from a well-mixed portion of a stream, it is likely representative of the 1-hour average concentration of the chemical in the stream and can be compared directly to the CMC. If this value is greater than the respective CMC, then a criterion *exceedance* has been observed. If two or more criterion exceedances are documented in a 3-year period, then the concentration, duration, and frequency terms have been met and a criterion *violation* has occurred.

> If a grab sample is collected from a well-mixed portion of a stream, it is likely representative of the 1-hour average concentration of the chemical in the stream and can be compared directly to the CMC.

This presumption is supported by an intensive investigation into seasonal and diurnal chemical patterns in Panther Creek, Idaho, in 1993–1994 (Beltman et al. 1994). Copper and cobalt concentrations were measured hourly for five 24-hour periods during and after spring runoff of a metals-contaminated tributary. During snowmelt, concentrations of dissolved copper varied by up to 5 times during a 24-hour period. The most extreme change within 1-hour was by a factor of 2. The vast majority of 1-hour differences during high runoff were by a factor of about 0.2. After the peak runoff, by early June diurnal differences were much lower—varying by factors of 0.2 to 0.4 during a 24-hour period. Replicate samples from stable flow conditions (September) varied by about 6% (factor of 0.06) on average. These data suggest that during stable flow conditions, a single grab sample from a well-mixed part of flowing water would be reasonably representative of concentrations for a 24-hour period.

In addition to diurnal and seasonal variation, Beltman et al. (1994) also examined the variability of field replicate samples. There are no criteria for field variability in commonly used standard methods (e.g., EPA 2010; USGS 1999; or APHA 1998). EPA QA/QC guidelines for *laboratory* replication are ± a factor of 0.2 (20%). Since real data that would be evaluated for criteria compliance would include inherent variability from sampling technique, sample handling, and laboratory variability, the inherent variability of field data is higher than from laboratory replicates. Therefore, differences of less than 20% between two repeat samples at a site are likely insignificant.

5.2.6.2.2 Durations for Criterion Continuous Concentrations (Chronic)

Chronic criteria are expressed as either 30-day average concentrations (ammonia) or 4-day average concentrations (most everything else). A single grab sample is unlikely to represent concentrations over an averaging period of 4 days or longer if concentrations are variable. Specifying the number of samples necessary to characterize 4-day average concentrations is not feasible without considering the variability of the data. If daily values for 4 consecutive days were available, their average would more likely represent a 4-day average. Unfortunately, these data are not routinely available for water body assessment purposes; only if the water body of interest is the focus of intensive investigation is such a rich data set likely to be available.

> If monthly or other periodic data show a CCC is exceeded for two or more consecutive periods, then the assessor may reasonably conclude that the 4-day average concentration was exceeded and an *exceedance* has been observed. If two or more criteria exceedances are documented in a 3-year period, then the concentration, duration, and frequency terms have been met and a criteria *violation* has occurred.

The water quality standards address this very real data limitation by suggesting a minimum of daily samples but allowing any number of data points to be used to estimate a 4-day average concentration. Idaho water quality standards define a 4-day average as "the average of all measurements within a period of ninety-six (96) consecutive hours" (IDAPA 58.01.02.010.40). Still, two such 4-day averages are needed within a 3-year period to establish a frequency of exceedance greater than allowed by chronic criteria. If monthly or other periodic data show a CCC is exceeded for two or more consecutive 4-day periods, then the assessor may reasonably conclude that the 4-day average concentration was exceeded and an *exceedance* has been observed. If two or more criteria exceedances are documented in a 3-year period, then the concentration, duration, and frequency terms have been met and a criteria *violation* has occurred.

6 Aquatic Life Use Support Determination

DEQ uses both ecological indicators and numeric water quality criteria to assess aquatic life use. The strength of the aquatic life use support determination is the use of ecological indicators in water quality assessments. Water quality is evaluated and compared to levels needed for the protection and maintenance of viable communities of aquatic species. Measurements of aquatic assemblages reflect long-term stream conditions more than instantaneous chemical measurements and provide a direct measure of the aquatic life beneficial use.

The aquatic life beneficial use comprises four general subcategories of beneficial uses: cold water, seasonal cold water, warm water, and modified. In addition is the more protective salmonid spawning sub-category of cold water.

Bioassessment procedures are described in the following subsections for cold water and salmonid spawning beneficial uses. Since the multimetric indices for cold water aquatic life communities were developed from statewide data sets that include sites with both cool and coldwater species present, it may be feasible to evaluate waters designated for seasonal cold water aquatic life uses using the cold water assessment procedures. However, reference conditions for seasonal cold waters would likely need to be established. Such an application will require further evaluation and consequently there are no assessment tools for seasonal cold water aquatic life uses.

No assessment tools for evaluating warm water or modified biological communities are presently available.

6.1 Water Body Size Determination

The WBAG uses water body size criteria to distinguish between two classes of flowing water: streams and rivers. This distinction is important since DEQ uses different sampling procedures and bioassessment indices to assess the aquatic life support use of these two classes. Section 2.1.6 describes the method used to determine water body size. For more details regarding the development of this method, refer to Grafe 2002a.

6.2 Multimetric Indices

The development of multimetric indices relevant to Idaho beneficial uses is a substantial research effort. Several years of data collection and extensive technical analyses provide the basis for use of these bioassessment tools in the assessment process. The specifics of these analyses are beyond the scope of this guidance; however, DEQ does provide this information in *Biological Assessment Frameworks and Index Development for Rivers and Streams in Idaho* (Jessup 2011).

6.2.1 Multimetric Index Description

A multimetric index, or MMI, is a numeric representation of biological or habitat conditions based on combined signals of many assemblage or physical measurements. Each measurement, or metric, is selected to be included in the index because it shows a consistent response along a known disturbance gradient. Depending on whether the assessment is being done on a stream or river, DEQ may use macroinvertebrate, fish, and habitat indices, which are discussed in detail in section 6.3.

To evaluate aquatic life use, DEQ has developed and applies MMIs based on rapid bioassessment concepts developed by EPA (Barbour et al. 1999). The indices include several characteristics to gauge overall ecosystem health. MMI scores are unitless, and therefore comparable.

The strength of such an approach is the integration of biological, physical, and chemical characteristics of the water body at different scales—individual, population, community, and ecosystem (Karr et al. 1986). This integration allows DEQ to detect water quality impairment cost-effectively and furnishes this information in an understandable format.

Data used to calculate certain indices, such as the fish index, may be limited due to sampling resource requirements, endangered or threatened species sampling restrictions, and sampling protocols incompatible with BURP methods. Therefore, DEQ has developed several bioassessment tools to limit reliance on just one tool and still ensure direct measurements of aquatic life beneficial use support.

6.2.2 Reference-Site Approach

DEQ sets expectations for aquatic life use support determination following the reference-site approach. The reference-site approach uses the biological and physical habitat condition at sites that are either minimally or least disturbed (Stoddard et al. 2006) as the benchmark for determining support.

> "Reference Condition" refers to the *range* of index scores at sites determined to be least or minimally impacted. Sites are not compared to a single reference site, but rather to all reference sites within their site class.

6.2.2.1 Determining Reference Condition

As part of the multimetric approach, reference sites are used to develop a range of conditions that can be divided into any number of categories indicating different levels of impairment (Barbour et al. 1999).

Reference sites were identified by indicators of the intensity of human activity within a site's upstream catchment (for streams) or its subwatershed (12-digit HUC) (for rivers). Those sites with the least amount of measureable human activity were considered reference sites. In addition, sites with the most measurable human activity were considered stressed sites.

The indicators of the intensity of human activity for streams were as follows:

- Population density at the site (people/square kilometer [km^2])
- Proportion of the upstream catchment with natural land uses
- Land Disturbance Index (LDI) for the upstream catchment (index units)
- Density of roads in the upstream catchment (km/km^2)
- Proportion of the upstream stream length within 100 meters of roads
- Density of mines in the upstream catchment, weighted by mine size (weighted number/km^2)
- Density of water diversion rights in the upstream catchment (rights/km^2)
- Density of NPDES permits in the upstream catchment (permits/km^2)
- Disruptive pressure observed in riparian zones during site visits (rating 1–20)
- Density of dams in the upstream catchment (dams/km^2)
- Grazing activity at the site (presence/absence)

The indicators of the intensity of human activity for rivers were as follows:

- Density of roads in the subwatershed (km/km^2)
- Proportion of the upstream stream length within 100 meters of roads
- LDI for the subwatershed (index units)
- Population density at the site (people/km^2)
- Axis 1 of a Principal Components Analysis of multiple stressor variables

Reference and stressed sites were used to develop and calibrate the MMIs. Further discussion of reference condition determination and supporting analyses can be found in Jessup (2011).

6.2.2.2 Reference Condition and Hydrologically Modified Waters

Based on the body of research leading to this assessment process, DEQ believes that most streams and rivers have the capacity for their biological and habitat parameters to measure within the ranges of comparable reference conditions. For most waters, if point or nonpoint pollution sources were managed, then biological and habitat parameters could be expected to be within the range of natural variability for reference conditions.

However, hydrologic modifications such as dams or diversions have fundamentally altered some streams and rivers from their original conditions, and their biological and physical conditions likewise have been fundamentally altered from their historical conditions. An obvious example is the conversion of a river to a reservoir. As aquatic conditions are changed from river to reservoir, conditions that favor trout and other fish adapted to cold, swift waters are shifted to pond-like conditions that favor warmwater fishes, largely introduced from the Midwest, such as large and smallmouth bass, carp, crappie, and catfish. These species may be considered desirable and represent “fishable” aquatic life and recreational beneficial uses. In another example, historically anadromous salmon inhabited the Snake River basin upstream to natural barrier waterfalls (e.g., Shoshone Falls and Malad Falls). Impassible dams and reservoirs (e.g., Dworshak Dam blocking the North Fork Clearwater River or the Hells Canyon dam complex blocking the Payette, Boise, and mid-Snake systems) make it unrealistic to expect the presence of steelhead trout or salmon in the rivers upstream of these hydrological modifications.

With this in mind, DEQ will consider the extent and magnitude of hydrological modifications on a case-by-case basis to determine whether or not the reference condition approach is appropriate.

6.2.2.3 Reference Condition and Water Quality Standards

Idaho Code states that reference streams or conditions shall be selected to represent the land types, land uses, and geophysical features found within the majority of the basins. Reference conditions are to be representative of either (1) natural conditions with few impacts from human activities or (2) minimum conditions needed to fully support the designated uses (Idaho Code §39-3606, IDAPA 58.01.02.010.83).

This direction is reflected in the DEQ assessment process. DEQ estimates reference condition by screening stream and river sampling sites and identifying those with few observed impacts from human activities. In terms of water quality standards, these sites are similar to the “highest level of support attainable in the basin” (IDAPA 58.01.02.010.83).

Also, DEQ organizes sampling locations into reasonably comparable groups based on factors like land type, land uses, geophysical features, climate, and water body size (see Idaho Code §39-3606), a process known as site classification (discussed below). If the water body in question has similar physical, chemical, or biological measures to those found at the reference condition within its site class, then the water body is considered to be “fully supporting” its aquatic life beneficial use (Idaho Code §39-3606).

6.2.3 Site Classification

Site classification is meant to classify natural variability and ensure that test sites are compared to an appropriate reference condition based on natural biological and physical factors. For streams, DEQ uses three site classes: (1) Mountains; (2) Foothills; and (3) Plains, Plateaus, and Broad Valleys (PPBV). For rivers, DEQ uses two site classes: (1) Mountains and (2) Non-mountains. Although classifications necessarily impose sharp boundaries on the landscape, these site classes have been demonstrated to account for much of the natural variability seen in Idaho streams (see Jessup 2011).

6.2.3.1 Stream Site Classes

Stream site classes were developed based first on the benthic macroinvertebrate assemblages in reference streams. This classification was then confirmed as a valid alternative for both fish and habitat as well.

Environmental factors that could account for the variability in stream benthic macroinvertebrates from reference sites were explored using Nonmetric Multidimensional Scaling (NMS) ordination. In addition, a Principal Components Analysis (PCA) of environmental variables at all sites was used. Variables that were most likely responsible for major differences among sites were closely related to ecoregions as described by McGrath et al. (2002).

These analyses resulted in the three site classes for streams: Mountains, Foothills, and PPBV (Figure 8).

Further discussion of stream site classes and supporting analyses can be found in Jessup (2011).

6.2.3.2 River Site Classes

For river site classes, we hypothesized that the stream site classes would be valid as river site classes. To test this hypothesis, we performed PCA of both natural and stressor variables. Stream site classes were significantly separated when both natural and stressor variables were used independently and when they were used together. The separation among site classes was strongest when considering natural variables only. The natural variables pertained to location, climate, topography, physical river characteristics, and land cover.

Due to the low number of river sites within the Foothills site class, the Foothills river sites were grouped with the PPBV sites. The PCA did not provide convincing evidence that the Foothill sites had more in common with the PPBV than with the Mountains. However, a cluster analysis of taxa in reference samples suggested that Foothills sites grouped with PPBV sites more often than with Mountains. Because the Foothills sites were intermediate to mountains and plains on the PCA stressor gradients, it is possible that grouping them with the PPBV could result in assessment bias. However, it was more reasonable to expect a Foothills site to meet biological expectations derived from PPBV and Foothills sites than to expect a Foothills site to meet biological expectations derived from Mountain and Foothills sites. This reasoning resulted in two site classes for rivers: Mountain and Non-mountain (Figure 9). Further discussion of river site classes and supporting analyses can be found in Jessup (2011).

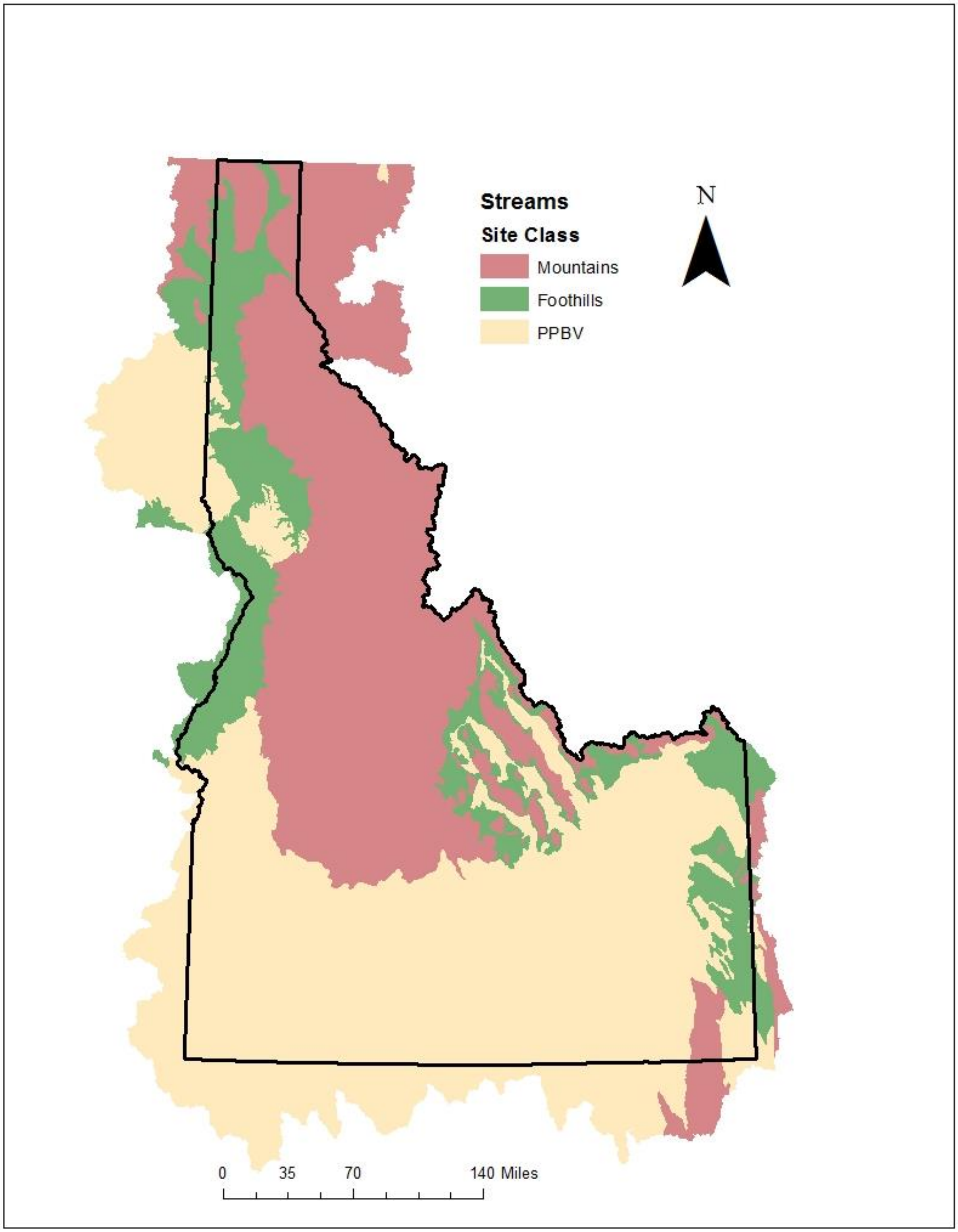

Figure 8. Location of stream site classes in Idaho.

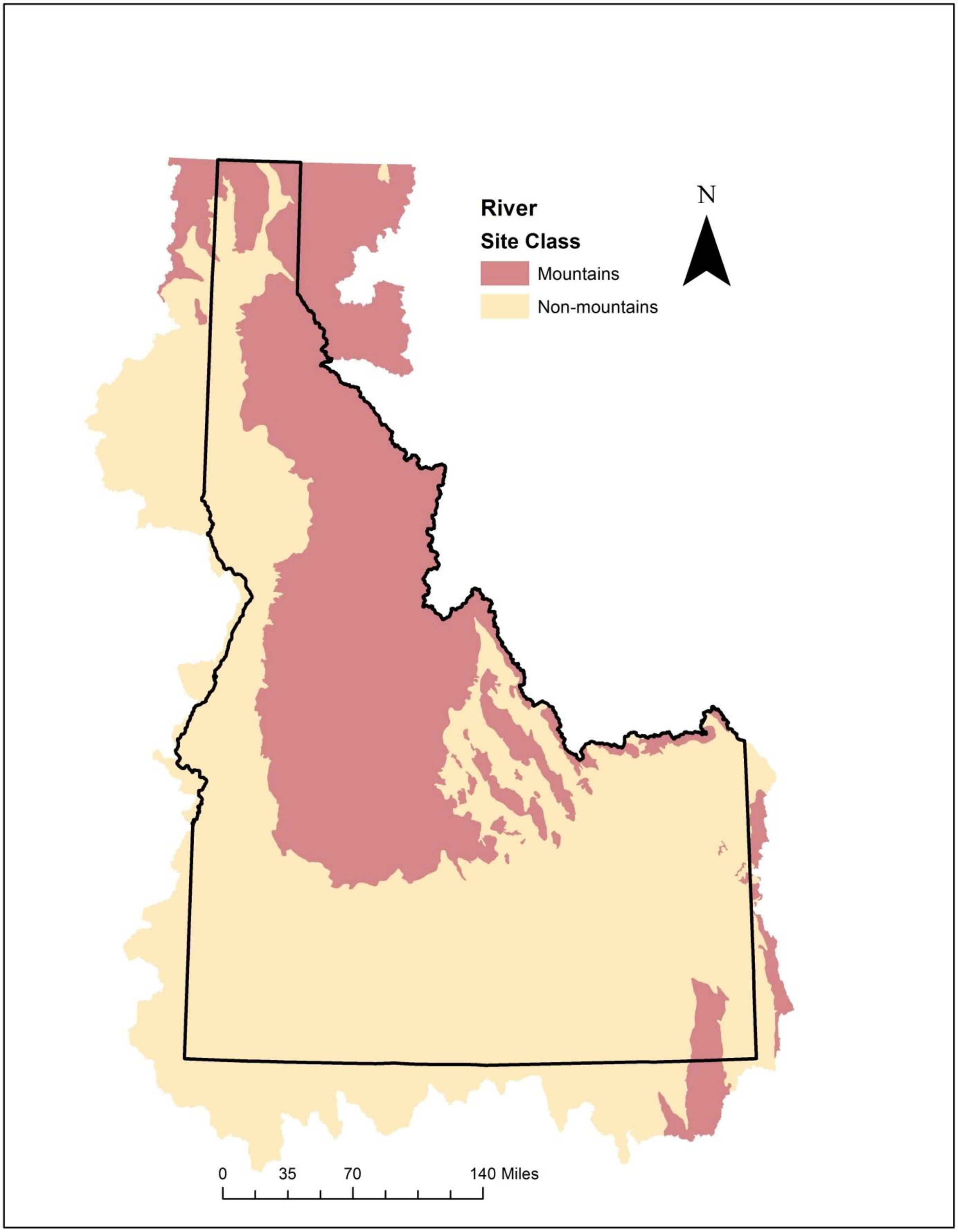

Figure 9. Location of river site classes in Idaho.

6.3 Development of Multimetric Indices for Idaho streams and rivers

The following describes how the MMIs were developed.

The results of these indices are assigned index ratings, and the combined site condition rating is used to evaluate support of cold water aquatic life. DEQ may also use physicochemical data to identify numeric criteria exceedances of water quality standards (see section 5.2) and/or other available data to support or modify assessment interpretations (see section 4.3).

Metrics refers to the individual measure, and the *metric value* is the raw value for that measurement. For example, the number of different taxa in a sample is a common metric, and the whole number count of taxa is a metric value. The *metric score* is derived from plugging the metric value into a specified equation.

Metrics scores are scored on a common scale prior to combination (as an average of scores) in an index. The scale ranges from 0 to 100 (as in Hughes et al. 1998 and Barbour et al. 1999). The optimal score is determined by the distribution of metric values. For metrics that decrease with increasing stress, the 95th percentile of all data within the site class was considered optimal (to lessen the influence of outliers [Barbour et al. 1999]) and scored as 100 points using the following equation:

$$MetricScore = \frac{100 * MetricValue}{95^{th}\ Percentile}$$

Metrics that increase with increasing stress (reverse metrics) were scored using the 5th percentile of data as the optimal, receiving a score of 100. Decreasing scores were calculated as metric values increased to the 95th percentile using the following equation:

$$MetricScore = \frac{100 * (95^{th}\ Percentile - MetricValue)}{95^{th}\ Percentile - 5^{th}\ Percentile}$$

In some cases, percentiles other than the 95th were used in the equation above to reduce the effects of a skewed distribution. The metric scoring range was from 0 to 100. Scores outside of this range were reset to the nearest extreme before the index was calculated.

An MMI is a combination of metric scores that indicates a degree of biological stress in the aquatic community (Barbour et al. 1999). Individual metrics were candidates for inclusion in the index if they did the following:

- Discriminated well between least and most disturbed sites
- Were ecologically meaningful (mechanisms of responses can be explained)
- Represented diverse types of information (multiple metric categories)
- Were not redundant with other metrics in the index

Several index alternatives were calculated using an iterative process of adding and removing metrics, calculating the *index score* as an average of the metric scores, and evaluating index responsiveness. The first index alternatives included those metrics that had the highest discrimination efficiencies (DEs) within each metric category.

Discrimination efficiency (DE) was calculated as the percentage of metric scores from stressed sites that were lower than the lower quartile of metric scores from reference sites.

Subsequent index alternatives were formulated by adding, removing, or replacing one metric at a time from the initial index alternatives that performed well. The index alternatives considered for the site classes in Idaho met the criteria listed above.

Each alternative index was evaluated based on DE (a measure of the overlap of scores from reference and stressed sites) and *z*-scores (a measure of deviation from the mean) in calibration data and inclusion of representative and nonredundant metrics. In addition, the DEQ workgroup reviewed indices with similar performance characteristics to select a final index that included metrics that were meaningful to our programs. As many metric categories as practical were represented in the index alternatives so that signals of various stressor-response relationships would be integrated into the index. While several metrics should be included to represent biological integrity, redundant metrics can bias an index to show responses specific to certain stressors or taxonomic responses. Redundancy was evaluated using a Spearman rank order correlation analysis. In this index development effort, we excluded metrics that were redundant at the 0.90 level or higher.

Index performance was validated with a set of samples that were not used in index calibration. Validation data were expected to perform as well as calibration data or to have a DE within 10% of the calibration DE. Index alternatives that were not adequately validated were reconsidered by the workgroup and a new alternative was selected.

MMIs were developed independently for each of the three stream site classes and the two river site classes. To differentiate between the multimetric indices used under previous editions of this guidance, these indices will hereafter be referred to as the Stream Macroinvertebrate Index 2 (SMI2), Stream Fish Index 2 (SFI2), and the Stream Habitat Index 2 (SHI2) or River Macroinvertebrate Index 2 (RMI2) and River Fish Index 2 (RFI2).

6.4 Aquatic Life Use Support Determination—Cold Water Aquatic Life

6.4.1 Stream (Wadable) Index Scoring

DEQ uses BURP-compatible data (see 4.2.3) to calculate MMI scores of macroinvertebrate community, fish community, and habitat integrity. The results of these indices are assigned index ratings, and the combined index ratings are used to evaluate support of cold water aquatic life. DEQ may also use physicochemical data to identify numeric criteria exceedances of water quality standards (see section 5.2) and/or other available data to support or modify assessment interpretations (see section 4.3).

6.4.1.1 Stream Macroinvertebrate Index 2 (SMI2)

The SMI2 includes from 6 to 7 metrics, depending on stream site class. DE ranged from 71% in the Foothills site class to 85% in the PPBV site class. Composition and performance of the SMI2 is presented in Table 9.

Table 9. Discrimination efficiency (DE) and metrics for the SMI2 in each of the three stream site classes.

	Mountains	Foothills	PPBV
DE	73%	71%	85%
Metrics	Total Taxa	EPT taxa (adjusted)	Simpson's index
	EPT Taxa	Non-insect % of taxa (adjusted)	% non-insects
	% Ephemeroptera and Plecoptera	% EPT, excluding Hydropsychidae	% filterers (adjusted)
	% filterers	Scraper taxa	% tolerant (adjusted)
	HBI (adjusted)	Tolerant taxa	% clingers
	Clinger taxa (adjusted)	Sprawler taxa (adjusted)	Semi-voltine taxa
	Semi-voltine taxa		

6.4.1.2 Stream Fish Index 2 (SFI2)

The SFI2 includes from 5 to 6 metrics, depending on stream site class. DE ranged from 78% in the Mountains site class to 86.7% in the PPBV site class. Composition and performance of the SFI2 is presented in Table 10.

Table 10. Discrimination efficiency (DE) and metrics for the SFI2 in each of the three stream site classes.

	Mountains	Foothills	PPBV
DE	78%	84.6%	86.7%
Metrics	Number of Native Taxa	Number of Minnow Taxa	Number of Native Taxa
	Individuals per native taxon	Salmon & Sculpin % of Taxa	Non-native % of Taxa
	% invertivores	Number of Benthic Taxa	% Minnow Individuals
	% lithophilic spawners	% Minnow Individuals	% Lithophilic Spawners
	% native intolerant individuals	% Moderately Tolerant	% Invertivores
		% filterers, omnivores, herbivores	% Piscivores

6.4.1.3 Stream Habitat Index 2 (SHI2)

The SHI2 consists of 10 metrics. Unlike SMI2 and SFI2, the SHI2 uses the same metrics regardless of stream site class. However, DEs were variable, depending on stream site class and ranged from 72.2 in the Foothills site class to 81.6% in the Mountains site class. Composition and performance of the SHI2 is presented in Table 11.

Table 11. Discrimination efficiency (DE) in each of the three stream site classes and metrics for the SHI2.

	Mountains	Foothills	PPBV
DE	81.6%	72.2%	80%
Metrics	Instream Cover (for fish) Score		
	% Fines within wetted width		
	% Bank Covered		
	LOD Count		
	Channel Shape Score		
	Canopy cover		
	Number of Wolman Size Classes		
	Embeddedness Score		
	Disruptive Pressure Score		
	Zone of Influence Score		

6.4.1.4 Stream Index Combination

The stream indices are a direct biological measure of cold water aquatic life. The details of index development and supporting analysis may be found in Jessup (2011).

DEQ uses a scoring approach similar to methods recommended in the Rapid Bioassessment Protocols (Barbour et al. 1999) and similar to the scoring approach used in the previous edition of this guidance.

Metric values are plugged into corresponding equations to produce individual *metric scores.* The average of the component *metric scores* is the individual *index score.* Each index is assigned an *index rating* based on comparison to reference condition. Then, for any given site, the index ratings are averaged. The average of index ratings for a given site is the *site condition rating* (Figure 10). The *site condition rating* is then used to determine support status, so that an average site condition rating ≥2 indicates full support of cold water aquatic life. Sites are only compared to the reference condition within their own respective site class.

Figure 10. From metric values to site condition rating.

To identify appropriate thresholds for assigning index ratings, DEQ evaluated six alternative threshold levels (Table 12), with thresholds based on quantiles of reference site scores.

The alternatives were evaluated based on the following three performance measures:

- Percent Type I errors (a reference site is misclassified as impaired)
- Percent Type II errors (a stressed site is misclassified as full support)
- Percent of all sites correctly classified as full support or impaired

DEQ analyzed the reference and impaired data sets to determine where there was a balance of Type I and Type II errors.

Table 12. Thresholds for index ratings for each of the six index combination alternatives evaluated. Numbers in parentheses correspond to quantiles of reference site scores where thresholds were set for each alternative.

Quantile of Reference Site Scores	Index Rating
Alternative 1 (0/5/10)	
< Minimum	0
Min – <5th Quantile	1
5th–10th Quantile	2
> 10th Quantile	3
Alternative 2 (0/10/25)	
< Minimum	0
Min – <10th Quantile	1
10th–25th Quantile	2
> 25th Quantile	3
Alternative 3 (5/10)	
<5th Quantile	1
5th–10th Quantile	2
> 10th Quantile	3
Alternative 4 (10/25)	
<10th Quantile	1
10th–25th Quantile	2
> 25th Quantile	3
Alternative 5 (10/50)	
<10th Quantile	1
10th–50th Quantile	2
> 50th Quantile	3
Alternative 6 (25/50)	
<25th Quantile	1
25th–50th Quantile	2
> 50th Quantile	3

DEQ then reviewed the reference criteria used for each site class to determine whether we wanted to minimize Type I or Type II errors. For example, in the Mountains site class, we had very strict reference criteria. In other words, sites had to be relatively pristine to be considered reference, and relatively little human perturbation could cause a site to be classified as impacted. Therefore, in the Mountains site class we should minimize Type I errors.

Conversely, in the PPBV site class, we had to loosen our reference criteria in order to have sufficient reference sites available for index development. In other words, many reference sites probably had some human perturbations affecting the biological and physical communities. Therefore, in the PPBV site class we should minimize Type II errors.

The performance of each alternative, by site class, is presented in Table 13.

Table 13. Performance of six alternatives for assessment thresholds for all three stream site classes. Selected thresholds are in bold.

			Mountains Site Class			
Alternative	1	2	3	4	**5**	6
Quantiles	(0/5/10)	(0/10/25)	(5/10)	(10/25)	**(10/50)**	(25/50)
% Type I	2.5	8.5	2.5	8.5	**12.0**	26.0
% Type II	46.9	30.6	51.0	30.6	**24.5**	16.3
% Correct	50.6	60.9	46.5	60.9	**63.5**	57.7
			Foothills Site Class			
Alternative	1	2	3	4	**5**	6
Quantiles	(0/5/10)	(0/10/25)	(5/10)	(10/25)	**(10/50)**	(25/50)
% Type I	2.6	7.9	2.6	7.9	**13.2**	28.9
% Type II	36.8	26.3	42.1	36.8	**21.1**	10.5
% Correct	60.6	65.8	55.3	55.3	**65.7**	60.6
			PPBV Site Class			
Alternative	1	2	3	4	5	**6**
Quantiles	(0/5/10)	(0/10/25)	(5/10)	(10/25)	(10/50)	**(25/50)**
% Type I	8.8	8.8	5.9	5.9	11.8	**23.5**
% Type II	33.3	23.5	52.9	37.3	19.6	**11.8**
% Correct	57.9	67.7	41.2	56.8	68.6	**64.7**

We have selected thresholds at the 10th and 50th quantile of reference for the Mountains and Foothills and the 25th and 50th quantile of reference for the PPBV. These thresholds provide a relative balance of Type I and Type II errors while acknowledging the degree of confidence we have in reference conditions in the Mountains and Foothills site classes relative to the PPBV site class.

The distributions of reference site and stress site index scores and the corresponding assessment thresholds are presented in Figure 11.

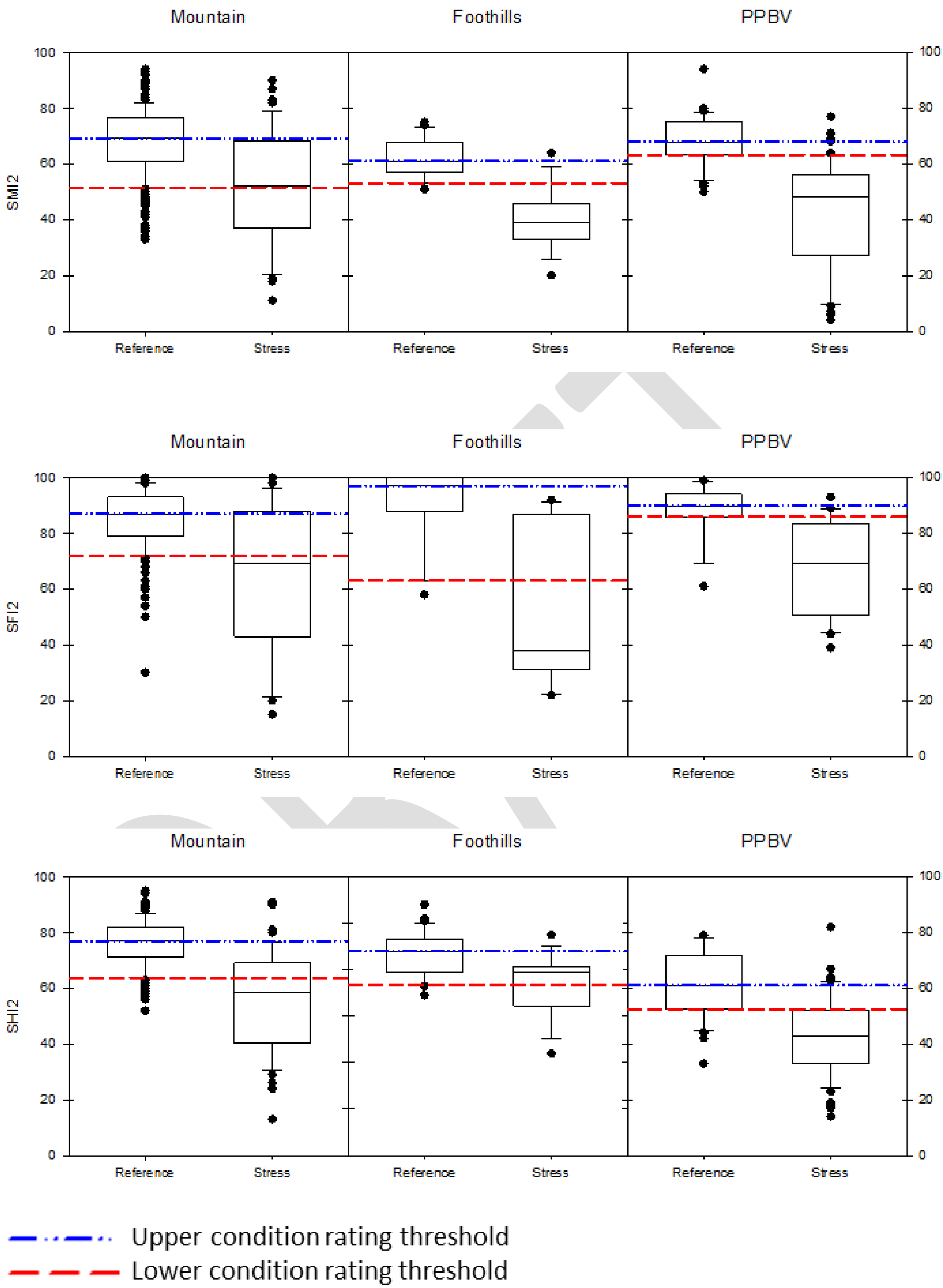

Figure 11. Distribution of reference and stressed streams and corresponding assessment thresholds for each index and site class.

6.4.2 River (Nonwadable) Index Scoring

Similar to the stream indices, DEQ uses BURP-compatible data to calculate multimetric index scores for macroinvertebrate and fish communities in rivers.

To differentiate between the MMIs used under previous editions of this guidance, these indices will hereafter be referred to as the River Macroinvertebrate Index 2 (RMI2) and the River Fish Index 2 (RFI2).

DEQ uses a weight of evidence approach in assessing Idaho's waters. While BURP (i.e., rapid bioassessment) data alone can be used to assess rivers, this approach is not preferred. For rivers especially, we expect in most cases for there to be abundant sources of other data to supplement BURP data in assessing the water quality and use support status.

6.4.2.1 River Macroinvertebrate Index 2 (RMI2)

The RMI2 consists of 7 metrics. DE was 70% in the Mountains site class and 92.7% in the Non-mountain site class. Composition of the RMI2 is presented in Table 14.

Table 14. Discrimination efficiency (DE) and metrics for the RMI2 in each of the river site classes.

	Mountains	Non-mountains
DE	70%	92.7%
Metrics	Number of EPT Taxa	Insect Taxa
	% EPT	Non-insect % of Taxa
	% Chironomidae	% Ephemeroptera
	% Predators	% Scrapers
	Number of Swimmer and Climber taxa	Sprawler Taxa
	Becks Biotic Index	% Tolerant
	Number of semi-voltine taxa	% Multivoltine

6.4.2.2 River Fish Index 2 (RFI2)

The RFI2 consists of 6 metrics. DE was 100% in the Mountains site class and 76.9% in the Non-mountains site class. Composition of the RFI2 is presented in Table 15.

Table 15. Discrimination efficiency (DE) and metrics for the RFI2 in each of the river site classes.

	Mountains	Non-mountains
DE	100%	76.9%
Metrics	Non-native % of Taxa	Native Taxa
	% Suckers	Non-native % of Taxa
	% filterer/omnivore/herbivore	Native Minnow Taxa
	Number Cyprinid Size Classes	Piscivore Taxa
	% Lithophils	% Lithophils
	Intolerant Taxa	Intolerant Taxa

6.4.2.3 River Index Combination

The river indices are a direct biological measure of cold water aquatic life. The details of index development and supporting analysis may be found in Jessup (2011).

River index scoring and assignment of condition rating is similar to scoring and condition rating used in streams. Similar to streams, for rivers the average of index ratings is used to determine site condition rating and support status, so that an average site condition rating ≥2 indicates full support of cold water aquatic life. Sites are only compared to reference condition within their own respective site class.

We evaluated the same six alternative thresholds for rivers as for streams (Table 12) and followed the same performance statistic measures.

The performance of each alternative, by site class, is presented in Table 16.

Table 16. Performance of six alternatives for assessment thresholds for all both river site classes. Selected thresholds are in bold.

Mountains Site Class						
Alternative	1	**2**	3	4	5	6
Quantiles	(0/5/10)	**(0/10/25)**	(5/10)	(10/25)	(10/50)	(25/50)
% Type I	4.2	**12.5**	4.2	12.5	12.5	20.8
% Type II	23.1	**7.7**	61.5	23.1	15.4	15.4
% Correct	72.7	**79.8**	34.3	64.4	72.1	63.8
Non-mountains Site Class						
Alternative	1	**2**	3	4	5	6
Quantiles	(0/5/10)	**(0/10/25)**	(5/10)	(10/25)	(10/50)	(25/50)
% Type I	0.0	**20.0**	0.0	20.0	20.0	20.0
% Type II	25.0	**18.8**	56.3	37.5	37.5	31.3
% Correct	75.0	**61.2**	43.7	42.5	42.5	48.7

We have selected thresholds at the minimum, 10th, and 25th quantile of reference for both the Mountains and Non-mountains river site classes. These thresholds provide a relative balance of Type I and Type II errors.

6.4.3 Index Data Integration Approach and Use Support Determination for Rivers and Streams

DEQ applies the index integration approach to determine aquatic life use support. However, as mentioned previously, DEQ may use physicochemical data to identify numeric criteria violations of water quality standards (see section 5) and/or other available data to support or modify assessment interpretations (see section 4). To use the multiple index integration approach, all data must be BURP-compatible and meet tier 1 criteria (see section 4).

DEQ believes that water bodies require an integration of multiple data types to assess ecosystem health. With this in mind, DEQ does not use any one piece of evidence to solely assess aquatic life use support. The multiple data integration approach is applied according to available data during the assessment process. If there are not enough data types to calculate two different indices, then the water body is not assessed until more data are gathered or other tier 1 data can be used according to policies described in section 4. Many types of data can bear on assessment of use support, and DEQ encourages consideration of all relevant data. The following steps focus on integration of DEQ's BURP collected data, and with water quality data relating to criteria compliance, to determine use support of cold water aquatic life for streams and rivers.

Step 1

- Are water column quality data available relevant to evaluating compliance with numeric water quality criteria? If no, go to step 2.
- Identify any numerical water quality standard violation as determined by using the criterion evaluation and exceedance policy (see section 5).
- If a numeric criteria violation occurred, then DEQ determines the water body is not fully supporting. Either way, proceed to step 2.

Step 2

- Are there sufficient BURP data?
- Calculate the index scores and determine if there are at least two indices.
- If there are less than two indices, and no data in step 1, then the water body is not assessed unless other tier 1 data are available (see section 4). Additional data should be gathered.

Step 3

- Identify corresponding index ratings for each index.

Step 4

- Average the index ratings to determine the site condition rating. To average the individual index ratings, sum the ratings and divide by the number of indices used.
- A site condition rating of ≥2 is considered fully supporting. A site condition rating <2 is considered not fully supporting.

- If more than one site was monitored within the assessment cycle, then assess according to the following logic:
  - If two sites were monitored, use lowest site condition rating. If more than two sites, take the average of site condition ratings.

Step 5

- Review these preliminary, quantitative results to ensure they meet logical expectations and data requirements. If not, re-evaluate the data and provide sound justification for support status ratings/assignments different from the indication of the quantitative results (see section 4.3) Remember that biological data that indicates full support of aquatic life use can be used to override infrequent (<10%), brief (<2 hours), or small (not causing acute effects) exceedances of numeric criteria for pH, turbidity, dissolved oxygen, and temperature (IDAPA 58.01.02.054.03).

6.5 Aquatic Life Use Support Determination—Salmonid Spawning

The Idaho water quality standards require that waters designated for salmonid spawning be protected if they "provide or could provide a habitat for active, self-propagating populations of salmonid fishes" (IDAPA 58.01.02.100.01.b). To evaluate salmonid spawning within the context of the aquatic life use support determination, DEQ must first interpret the regulatory intent of the water quality standards and EPA guidance. DEQ then applies an assessment approach that meets this intent and is workable based on current science and available resources. This approach is applied similarly to small streams and rivers.

6.5.1 Regulatory Interpretation of Salmonid Spawning Use Support

In interpreting regulatory requirements, DEQ considered regulatory definitions, guidance, and numeric criteria. The water quality standards define salmonid spawning criteria as a subcategory of the aquatic life beneficial use (IDAPA 58.01.02.100). EPA guidance directly addresses aquatic life use bioassessment but does not separate bioassessment of salmonid spawning or other subcategories of aquatic life use (EPA 2010; EPA 1997). This regulatory structure and guidance implies that salmonid spawning is a part of the overall aquatic life use support determination. DEQ views salmonid spawning as a subcategory of cold water aquatic life.

Additionally, the definition of salmonid spawning states "habitat" should be protected for salmonid fish. Salmonid spawning generally requires habitat that contains well-oxygenated gravel substrate and cold water for egg incubation. The Idaho water quality standards address these requirements through numeric criteria for dissolved oxygen and temperature specific to salmonid spawning (IDAPA 58.01.02.250.02.f). The water quality standards also provide for different ammonia criteria to be met "when early life stages are likely present."

> Because use designations do not require a use be actually attained, and because evidence of actual spawning activity may be difficult to obtain, and because lack of evidence does not prove lack of use, what we are assessing with salmonid spawning criteria is only that water quality is suitable to support salmonid spawning.

Consequently, DEQ evaluates these numeric criteria for salmonid spawning independently from cold water aquatic life. Because sediment, particularly measures of embeddedness and percent intergravel fines, is important to successful spawning, DEQ also apples its narrative sediment criterion (IDAPA 58.01.02.200.08) to assess conditions supportive of salmonid spawning.

6.5.2 Assessment Approach

DEQ has developed quantitative fish indices (SFI2 and RFI2) that incorporate direct measurements of healthy fish communities. DEQ has revised the stream habitat index (SHI2) to better reflect conditions affecting aquatic condition. DEQ applies a scientifically defensible approach, which, depending on water body size (see section 2), uses a combination of different biological indices (fish and macroinvertebrates) and physical habitat and relevant salmonid spawning criteria information (temperature, DO, ammonia, and some sediment measures). In light of these bioassessment developments and interpretations of regulatory intent, DEQ believes it is reasonable to evaluate salmonid spawning within the context of the aquatic life use support determination and applicable criteria (temperature, DO, ammonia, and some sediment measures). Such a process considers the ecological health of fish communities and addresses criteria specific to salmonid spawning. This approach applies similarly to streams and rivers. Nationally, this approach seems consistent with methods used by many other states (EPA 1997; EPA 2000). The following steps summarize this approach:

Step 1

- Is salmonid spawning designated?
  - If no, go to step 2.
  - If ye**s**, go to step 4.

Step 2

- Are any salmonids present that measure ≤100 mm?
  - If **no**, go to 3
  - If **yes**, then salmonid spawning is an existing use (see section 3.2.2); go to step 4.

Step 3

- Was salmonid spawning previously an existing use?
  - If **no**, then do not assess, as there is no evidence that salmonid spawning should be an assessed use for this water body.
  - If **yes**, then the water body is considered to be not fully supporting the *existing use* of salmonid spawning. **However, the assessor should review other data, if available, to confirm that salmonid spawning is no longer supported in the water body.**

Step 4

- Is the aquatic life use fully supported?
  - If **no**, then salmonid spawning is also not fully supported.
  - If **yes**, go to step 5.

Step 5

- Are there any violations of numeric criteria for salmonid spawning?
  - If **no**, go to step 6.
  - If **yes**, then salmonid spawning is not fully supported.

Step 6

- Do BURP data indicate ≥2 individual salmonids ≤100 mm?
  - If **yes**, then salmonid spawning is fully supported.
  - If **no**, then salmonid spawning is unassessed.

Salmonid spawning is a subcategory of cold water aquatic life use and carries all of the criteria of cold water aquatic life. Therefore, if cold water aquatic life is not supported, and salmonid spawning is an existing or designated use, salmonid spawning cannot be fully supported, regardless of the cause of impairment.

However, this relationship is hierarchical, and it is therefore possible to not be supporting salmonid spawning while still fully supporting cold water aquatic life.

6.5.3 Use of Outside Data

Although DEQ collects electrofishing data for streams, the agency depends heavily on fisheries data collected by other entities. This is particularly true for large rivers, since DEQ does not routinely collect fisheries data. Additionally, DEQ collection of fisheries data continues to be limited due to endangered or threatened species. With this in mind, it is particularly important for the assessor to locate BURP-compatible fisheries data collected outside DEQ for the SFI2 and RFI2 calculations and subsequent aquatic life use support determinations. It is also important for the assessor to coordinate with fish management agencies, such as IDFG, when evaluating salmonid spawning.

6.6 Aquatic Life Use Support Approach and Legal Requirements

Idaho Code and the water quality standards provide direction for aquatic life use determination and monitoring waters to conduct beneficial use attainability analyses and status surveys. Idaho water quality standards state that aquatic life communities are "beneficial uses" of waters and that where attainable, desirable species of aquatic life communities be maintained or restored (IDAPA 58.01.02.050.02). DEQ's approach to determining whether aquatic life beneficial uses are attained include, but are not limited to, comparing biological and habitat parameters in the stream or water body of interest with those found in reference streams or conditions. DEQ considers whether all water quality standards are met and whether a healthy, balanced biological community is present (IDAPA 58.01.02.054).

The cold water aquatic life assessment process follows guidance from Idaho water quality standards and Idaho Code (Table 17). The Idaho water quality standards state that DEQ shall use biological and aquatic habitat parameters listed in Table 17 and in the current version of the WBAG. These parameters may include, but are not limited to, those listed in Table 17.

Table 17. Biological and aquatic habitat indicators, applicable water quality standards, and applicable tools for assessing aquatic life use.

Indicator	Water Quality Standards (IDAPA 58.01.02.054, Idaho Code §39-3606)	Tools
Aquatic Habitat	Stream width and depth, shade, sediment impacts, bank stability, and water flows	SHI2
Biological (aquatic macroinvertebrates)	Evaluation of Ephemeroptera, Plecoptera, and Trichoptera, Hilsenhoff Biotic Index, and functional feeding groups	SMI2, RMI2
Biological (fish)	Number and variety of fish to determine community functionality and diversity	SFI2, RFI2

The actual parameters selected for use in the aquatic life use support determination depended on their supporting scientific analyses. For example, the SMI2 includes all the parameters listed in the water quality standards (Table 17), plus parameters of richness and pollution tolerance. The SFI2 includes number of coldwater fish, diversity of ages of fish, and variety of native species among other parameters that distinguished between reference and disturbed sites.

7 Contact Recreation Use Support Determination

The Idaho water quality standards provide for water bodies to be protected for either primary or secondary contact recreation use. Primary contact recreation is often considered the “swimmable” goal of the Clean Water Act, where a moderate to high probability exists of prolonged and intimate water contact by humans. Primary contact recreation activities include swimming, water skiing, or skin diving where ingestion of small quantities of water is likely to occur. Secondary contact recreation is often considered recreation “on” or “about” the water and may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur.

7.1 Recreation Criteria Evaluation Policy

DEQ evaluates recreation criteria using tier 1 data that are less than 5 years old. For narrative criteria, DEQ investigates beach or swimming closures occurring in the last 5 years to identify potential exceedances. If two or more closures indicate a toxic substance as the cause, then DEQ concludes the water body is not fully supporting contact recreation. Figure 12 illustrates the use determination process for contact recreation.

DEQ also evaluates other evidence that indicates an exceedance of numeric criteria. For toxic substances criteria, DEQ concludes not fully supporting if there are any exceedances of toxic substance criteria as specified in IDAPA 58.01.02.210.01–02 (Figure 12). Bacteria numeric criteria, data, and evaluation are discussed below.

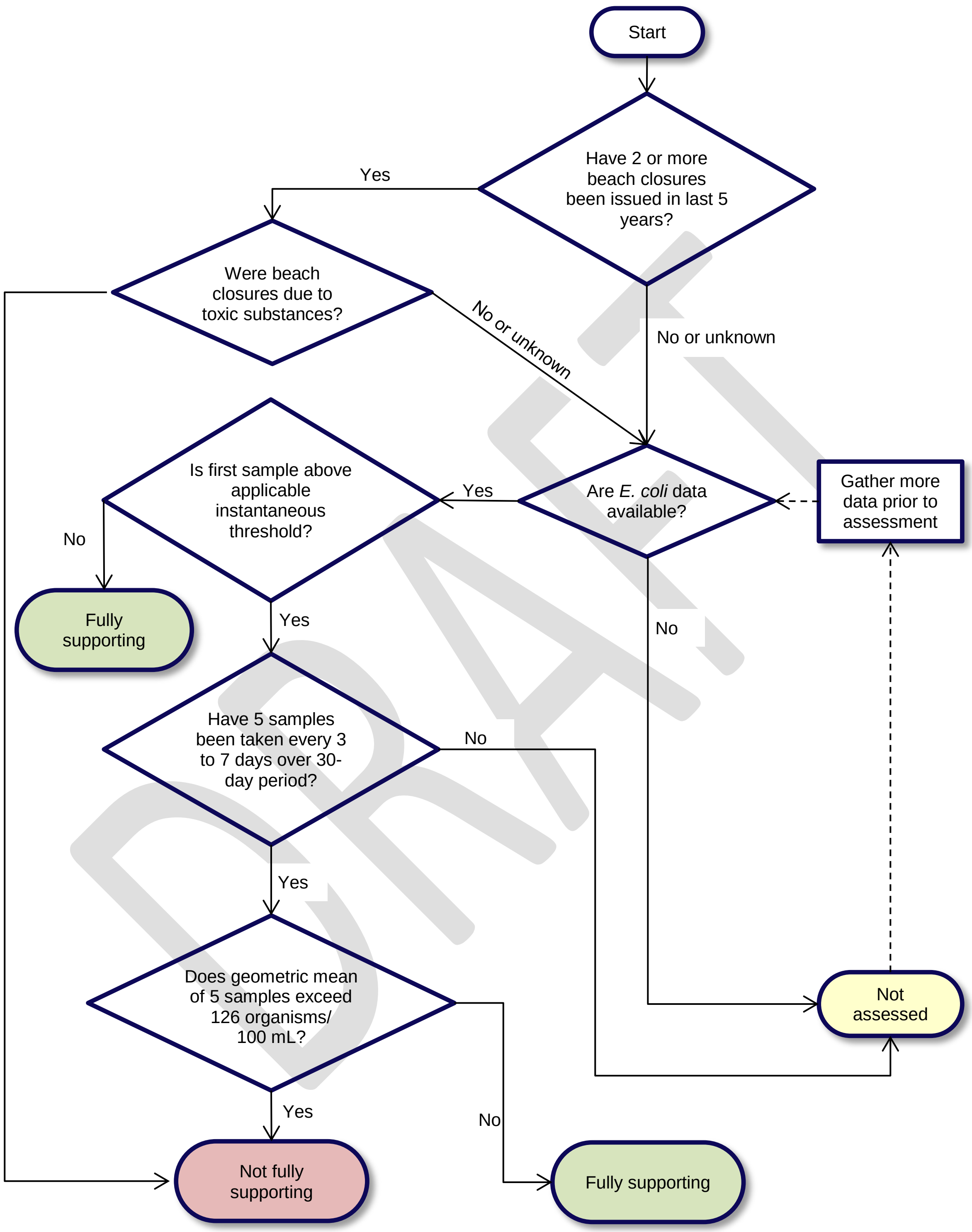

Figure 12. Flow chart for determining recreational use support.

7.2 Bacteria Data

The numeric bacteria criterion for an exceedance is the same for public swimming beaches, primary contact recreation (PCR), and secondary contact recreation (SCR): 126 *E. coli* organisms per 100 mL calculated as a geometric mean of five samples taken within 30 days, with at least 3 but no more than 7 days between sampling events (i.e., cannot take five samples in less than 15 days or more than 30 days). However, the instantaneous threshold to trigger additional sampling is different for these three types of recreation and depends on the designated and/or existing use for the water being assessed (Table 18).

Exceedance of a threshold alone DOES NOT indicate a violation of criteria. Criteria violations can only occur based on comparison of a geometric mean of 5 samples.

Table 18. Designated and/or existing uses and their associated threshold values to trigger additional monitoring.

Designated or Existing Use	Threshold (colony forming units/100 mL)
Public Swimming Beach (PSB)	235
Primary Contact Recreation (PCR)	406
Secondary Contact Recreation (SCR)	576

To assess a water body for contact recreation, the assessor must first identify the designated or existing use at the sample location. Results from a single sample are then compared to the threshold values (Table 18) to determine if additional monitoring is needed. If the appropriate threshold is not exceeded, then the water body is assumed to be fully supporting contact recreation (Figure 12).

If the *E. coli* bacteria count exceeds the appropriate threshold, additional sampling is required to evaluate compliance with the criteria (IDAPA 58.01.02.251.01). If, after collecting additional samples, the geometric mean of five samples taken within 30 days (with a minimum of 3 and no more than 7 days between sampling events) exceeds 126 colony forming units/100 mL, the water body is determined to not fully support contact recreation. If the geometric mean is ≤126 colony forming units/100 mL, then the water body fully supports contact recreation.

8 Water Supply Use Support Determination

There are three categories of water supply uses: domestic, industrial, and agricultural. Domestic water supply is either an existing use (see section 3.2.4 regarding existing domestic water supply) or designated in the tables shown in IDAPA 58.01.02.110–160. Domestic water supply support must be assessed based on available information.

All waters of the state are designated for industrial and agricultural water supply and are generally considered to be fully supporting these uses unless evidence to the contrary exists. There are no presumed use protections in the water supply use category.

8.1 Domestic Water Supply (Drinking Water)

The beneficial use of domestic water supply is designated for a subset of waters in the state. Those water bodies that have a DWS marking in the tables of IDAPA 58.01.02.110–160 are designated for domestic water supply. For those water bodies where a domestic water supply is designated or where domestic water supply is an existing use (see section 3.2.4), it is up to the assessor to determine if the water body supports this use.

Generally, assessment of domestic water supply uses requires the assessor to evaluate criteria identified in three sections of Idaho's water quality standards:

- IDAPA 58.01.02.200, General Surface Water Quality Criteria
- IDAPA 58.01.02.210, Numeric Criteria for Toxic Substances for Waters Designated for Aquatic Life, Recreation, or Domestic Water Supply Use (column C1 of the associated table)
- IDAPA 58.01.02.252, Surface Water Quality Criteria for Water Supply Use Designation

If existing and readily available data show an exceedance of criteria values listed in IDAPA 58.01.02.210 column C1 as defined by the exceedance policy outlined in section 5.2 of this guidance, then the water body should be assessed as not fully supporting its domestic water supply beneficial use.

In addition, some waters in the state are designated as small public water supplies. These waters are listed in IDAPA 58.01.02.252.01.b.i. Idaho has over 1,900 public water systems, roughly 80% of which serve 500 or fewer people. In Idaho, 95% of drinking water comes from ground water, and only 5% is supplied by surface water. The water quality standards (IDAPA 58.01.02.252.01) identify those water bodies designated as small public water supplies and identify criteria that should be evaluated when assessing these water bodies for domestic water supply. Only those water bodies identified as public water supply and that have watersheds above the public water supply intake are required to meet the turbidity criteria outlined in 58.01.02.252.01.b.ii.

The assessor should coordinate with the DEQ regional office drinking water staff to determine if a particular water body supplies a public water system and identify any numeric criteria exceedances of the ambient surface water quality standards for water supply (IDAPA 58.01.02.210). The assessor should also coordinate with the DEQ Source Water Program to identify potential contaminant threats to public drinking water systems due to impaired surface water quality. The source water assessments include a delineation of the source water assessment area, inventory of potential contaminants within the delineated area, and a susceptibility analysis of the potential contaminants (DEQ 1999).

The source water assessment results are compiled in a report available online through the source water assessment database that includes any violations of drinking water standards. The DEQ assessor will review these reports and coordinate with the Source Water Program to identify any numeric criteria exceedances of the surface water quality standards for water supplies. DEQ also will review any additional data supplied by third parties for numeric criteria exceedances.

DEQ will take the following steps to make a use support determination for domestic water supply:

1. If numeric criteria exceedances of the ambient surface water quality standards for water supply exist (IDAPA 58.01.02.210), then the water body is not fully supporting and documentation of this assessment should follow the policy outlined in section 5.2.
2. If narrative criteria exceedances of the ambient surface water quality standards for water supply exist, then the water body is not fully supporting and documentation of this assessment should follow the policy outlined in section 5.1.
3. Absent evidence to the contrary, DEQ will presume the domestic water supply use is fully supported.

8.2 Agricultural and Industrial Water Supply

Agricultural and industrial water supply uses are applied to all surface waters of the state (IDAPA 58.01.02.100.03), which means they are considered to be designated beneficial uses for all water bodies. In general, water quality criteria for these uses are found under IDAPA 58.01.02.200, General Surface Water Quality Criteria, and are typically narrative in nature. DEQ will consider agricultural and industrial water supplies fully supported unless evidence to the contrary is supplied. Excessive nutrients or toxic contaminants might result in a not fully supporting determination.

The assessor should refer to IDAPA 58.01.02.252.02–03 and provide a documented rationale for a not fully supporting determination. When assessing a water body for support of agricultural and industrial water supply beneficial uses, the assessor should refer to section 5.1. Collecting additional data to support such a determination is recommended.

DEQ will take the following steps to make a use support determination for agricultural and industrial water supply:

1. If narrative criteria exceedances of the ambient surface water quality standards for water supply exist, then the water body is not fully supporting and documentation of this assessment should follow the policy outlined in section 5.1.
2. Absent evidence to the contrary, DEQ will presume agricultural and industrial water supply uses are fully supported.

9 Wildlife Habitat and Aesthetics Use Support Determination

Wildlife habitat and aesthetics are designated uses for all surface waters of Idaho. Absent evidence to the contrary, DEQ policy is to presume these uses are fully supported. Evidence to the contrary would likely occur through a public forum or from documentation submitted by wildlife experts (e.g., IDFG, US Fish and Wildlife Service, universities, etc.).

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Appendix A. Empirically Derived Macroinvertebrate Cold Water Indicator Taxa List

The following macroinvertebrate taxa were identified as coldwater indicator taxa by analyzing temperature and species co-occurrence from the existing Beneficial Use Reconnaissance Program (BURP) database. To identify obligate coldwater taxa found in Idaho streams, the temperature data and macroinvertebrate communities of more than 6,000 BURP sampling locations were analyzed.

Two criteria were used to identify macroinvertebrates as coldwater indicators: (1) taxa that had their 75th percentile of occurrence below 13 °C, the mean temperature within the data set, and (2) taxa that had their 90th percentile of occurrence at temperatures below 20 °C. The result was 59 coldwater obligate taxa that commonly occur in Idaho stream samples.

Details of this analysis can be found in Richards et al. (2013).

Empirically Derived Cold Water Taxa List	
Ameletus similior	*Parapsyche* sp.
Anagapetus sp.	*Parorthocladius* sp.
Annelida	*Polycelis coronata*
Baetis bicaudatus	*Polycelis* sp.
Bryelmis idahoensis	*Pseudodiamesa* sp.
Caudatella hystrix	Psychodidae
Cinygmula sp.	*Rhithrogena robusta*
Cryptochia sp.	*Rhyacophila alberta* gr.
Despaxia augusta	*Rhyacophila betteni* gr.
Drunella coloradensis	*Rhyacophila iranda* gr.
Enchytraeidae	*Rhyacophila narvae*
Epeorus deceptivus	*Rhyacophila pellisa*
Epeorus grandis	*Rhyacophila pellisa/valuma*
Epeorus sp.	*Rhyacophila sibirica* gr.
Ephemerellidae	*Rhyacophila valuma*
Eukiefferiella tirolensis	*Rhyacophila verrula*
Haplotaxis sp.	*Rhyacophila verrula* gr.
Hydrobaenus sp.	*Rhyacophila vofixa* gr.
Hydryphantidae	*Sericostriata surdickae*
Krenopelopia sp.	*Setvena* sp.
Krenosmittia sp.	*Stilocladius* sp.
Leuctridae	*Taeniopterygidae*
Neothremma alicia	*Testudacarus* sp.
Neothremma sp.	*Tokunagaia* sp.
Oligophlebodes sp.	*Visoka cataractae*
Oreogeton sp.	*Yoraperla brevis*
Paraleuctra sp.	*Yoraperla* sp.
Paraperla sp.	*Zapada columbiana*
Paraphaenocladius "n. sp."	*Zapada oregonensis* gr.
Parapsyche elsis	

Appendix B. Literature Review–Derived Macroinvertebrate Coldwater Indicator Taxa List

The following macroinvertebrate taxa are identified as coldwater taxa based on scientific literature.

Taxon Name	Literature-Derived Temperature Tolerance
Capniidae	Stenothermal: cold
Capnia	Stenothermal: cold
Leuctridae	Stenothermal: cold
Despaxia	Stenothermal: cold
Despaxia augusta	Stenothermal: cold
Paraleuctra	Stenothermal: cold
Prostoia	Stenothermal: cold
Prostoia besametsa	Stenothermal: cold
Visoka	Stenothermal: cold
Visoka cataractae	Stenothermal: cold
Zapada columbiana	Stenothermal: cold
Peltoperlidae	Stenothermal: cold
Yoraperla	Stenothermal: cold
Yoraperla brevis	Stenothermal: cold
Taeniopterygidae	Stenothermal: cold
Paracapnia	Stenothermal: cold
Taenionema	Stenothermal: cold
Perlomyia	Stenothermal: cold
Brundiniella	Stenothermal: cold
Doroneuria	Stenothermal: cold
Doroneuria baumanni	Stenothermal: cold
Doroneuria theodora	Stenothermal: cold
Megarcys	Stenothermal: cold
Perlinodes aurea	Stenothermal: cold
Soliperla	Stenothermal: cold
Baetis bicaudatus	Stenothermal: cold
Rhabdomastix	Stenothermal: cold
Parameletus	Stenothermal: cold
Caudatella	Stenothermal: cold
Caudatella hystrix	Stenothermal: cold
Drunella spinifera	Stenothermal: cold
Ephemerella infrequens	Stenothermal: cold
Oreogeton	Stenothermal: cold
Blephariceridae	Stenothermal: cold
Agathon	Stenothermal: cold

Taxon Name	Literature-Derived Temperature Tolerance
Bibiocephala	Stenothermal: cold
Blepharicera	Stenothermal: cold
Philorus	Stenothermal: cold
Deuterophlebiidae	Stenothermal: cold
Deuterophlebia	Stenothermal: cold
Caudatella edmundsi	Stenothermal: cold
Epeorus grandis	Stenothermal: cold
Parochlus	Stenothermal: cold
Setvena bradleyi	Stenothermal: cold
Boreoheptagyia	Stenothermal: cold
Boreochlus	Stenothermal: cold
Paraboreochlus	Stenothermal: cold
Krenopelopia	Stenothermal: cold
Zavrelimyia	Stenothermal: cold
Diplocladius	Stenothermal: cold
Heleniella	Stenothermal: cold
Pisidium casertanum	Stenothermal: cold
Parachaetocladius	Stenothermal: cold
Psilometriocnemus	Stenothermal: cold
Prosimulium	Stenothermal: cold
Hesperoconopa	Stenothermal: cold
Erpobdellidae	Stenothermal: cold
Anagapetus	Stenothermal: cold
Parapsyche elsis	Stenothermal: cold
Apatania	Stenothermal: cold
Homophylax	Stenothermal: cold
Neothremma	Stenothermal: cold
Oligophlebodes	Stenothermal: cold
Rhyacophila tucula	Stenothermal: cold
Rhyacophila verrula	Stenothermal: cold
Parasimulium	Stenothermal: cold
Moselia infuscata	Stenothermal: cold
Doddsia occidentalis	Stenothermal: cold
Frisonia picticeps	Stenothermal: cold
Setvena	Stenothermal: cold
Pictetiella expansa	Stenothermal: cold
Rickera	Stenothermal: cold
Rickera sorpta	Stenothermal: cold
Allomyia	Stenothermal: cold
Goeracea	Stenothermal: cold

Taxon Name	Literature-Derived Temperature Tolerance
Allocosmoecus partitus	Stenothermal: cold
Amphicosmoecus	Stenothermal: cold
Amphicosmoecus canax	Stenothermal: cold
Eocosmoecus	Stenothermal: cold
Eocosmoecus schmidi	Stenothermal: cold
Farula	Stenothermal: cold
Sericostriata	Stenothermal: cold
Sericostriata surdickae	Stenothermal: cold
Agathon sp.	Stenothermal: cold
Allomyia sp.	Stenothermal: cold
Amphicosmoecus sp.	Stenothermal: cold
Anagapetus sp.	Stenothermal: cold
Apatania sp.	Stenothermal: cold
Bibiocephala sp.	Stenothermal: cold
Blepharicera sp.	Stenothermal: cold
Boreoheptagyia sp.	Stenothermal: cold
Brundiniella sp.	Stenothermal: cold
C. Barr undescribed sp.	Stenothermal: cold
Capnia sp.	Stenothermal: cold
Cascadoperla sp.	Stenothermal: cold
Caudatella sp.	Stenothermal: cold
Caurinella idahoensis	Stenothermal: cold
Caurinella sp.	Stenothermal: cold
Chyranda centralis	Stenothermal: cold
Chyranda sp.	Stenothermal: cold
Despaxia sp.	Stenothermal: cold
Deuterophlebia sp.	Stenothermal: cold
Diplocladius sp.	Stenothermal: cold
Doroneuria sp.	Stenothermal: cold
Eocosmoecus sp.	Stenothermal: cold
Farula sp.	Stenothermal: cold
Goeracea sp.	Stenothermal: cold
Heleniella sp.	Stenothermal: cold
Hesperoconopa sp.	Stenothermal: cold
Homophylax sp.	Stenothermal: cold
Krenopelopia sp.	Stenothermal: cold
Megaleuctra sp.	Stenothermal: cold
Megarcys sp.	Stenothermal: cold
Neothremma sp.	Stenothermal: cold
Oligophlebodes sp.	Stenothermal: cold

Taxon Name	Literature-Derived Temperature Tolerance
Oliveridia sp.	Stenothermal: hyper cold
Oreogeton sp.	Stenothermal: cold
Paraboreochlus sp.	Stenothermal: cold
Paracapnia sp.	Stenothermal: cold
Parachaetocladius sp.	Stenothermal: cold
Paraleuctra sp.	Stenothermal: cold
Parameletus sp.	Stenothermal: cold
Parasimulium sp.	Stenothermal: cold
Parochlus sp.	Stenothermal: cold
Perlomyia sp.	Stenothermal: cold
Philocasca sp.	Stenothermal: cold
Philorus sp.	Stenothermal: cold
Prosimulium sp.	Stenothermal: cold
Prostoia sp.	Stenothermal: cold
Psilometriocnemus sp.	Stenothermal: cold
Rhabdomastix fascigera gr.	Stenothermal: cold
Rhabdomastix setigera gr.	Stenothermal: cold
Rhabdomastix sp.	Stenothermal: cold
Rhyacophila alberta gr.	Stenothermal: cold
Rhyacophila vagrita gr.	Stenothermal: cold
Rhyacophila vofixa gr.	Stenothermal: cold
Rickera sp.	Stenothermal: cold
Sericostriata sp.	Stenothermal: cold
Setvena sp.	Stenothermal: cold
Soliperla sp.	Stenothermal: cold
Taenionema pallidum	Stenothermal: cold
Taenionema sp.	Stenothermal: cold
Visoka sp.	Stenothermal: cold
Yoraperla mariana	Stenothermal: cold
Yoraperla sp.	Stenothermal: cold
Zavrelimyia sp.	Stenothermal: cold
Boreochlus sp.	Stenothermal: cold

Appendix C. Coldwater Fish Taxa List

The following fish taxa are identified as coldwater taxa based on Zaroban et al. (1999).

Cold Water Fish Taxa	
Acipenser transmontanus	*Prosopium coulteri*
Acipenseridae	*Prosopium spilonotus*
Catostomus catostomus	*Prosopium williamsoni*
Coregonus	*Salmo*
Coregonus clupeaformis	*Salmo salar*
Cottus	*Salmo trutta*
Cottus beldingii	Salmonidae
Cottus cognatus	*Salvelinus*
Cottus confusus	*Salvelinus alpinus*
Cottus extensus	*Salvelinus confluentus*
Cottus greenei	*Salvelinus fontinalis*
Cottus leiopomus	*Salvelinus namaycush*
Cottus rhotheus	*Thymallus*
Couesius	*Thymallus arcticus*
Couesius plumbeus	Acipenseridae sp.
Lota	*Coregonus sp.*
Lota lota	*Oncorhynchus sp.*
Oncorhynchus	*Salmo sp.*
Oncorhynchus aguabonita	*Salvelinus sp.*
Oncorhynchus clarkii	*Prosopium sp.*
Oncorhynchus gilae	*Thymallus sp.*
Oncorhynchus keta	*Couesius sp.*
Oncorhynchus kisutch	*Lota sp.*
Oncorhynchus mykiss	*Cottus sp.*
Oncorhynchus nerka	*Oncorhynchus clarki*
Oncorhynchus tshawytscha	*Cottus beldingii*
Osmerus mordax	*Oncorhynchus clarki X O. mykiss*
Prosopium	*Salvelinus fontinalis X S. confluentus*
Prosopium abyssicola	*Prosopium gemmiferum*

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Appendix D. Tier 1 Data Checklist

Tier 1 Data Checklist for Assessment

Source of submitted data: ________________________

Date data submitted: ___________________

Contact information for data submitted: ________________________

If any of the questions below are answered with a no, the data are not tier 1 and should not be used to make a listing determination as per DEQ's *Water Body Assessment Guidance*.

Tier 1 Data Review:

Was data collection performed under documented monitoring plan with a quality assurance component?

Was monitoring plan submitted with data?

Was monitoring plan reviewed for quality assurance objective?

Person reviewing monitoring plan: ________________________

Was data collection performed by professional scientist or trained technician with appropriate supervised training?

Were samples submitted for analysis to an EPA-certified lab following standard methods?

Were biological samples submitted to a professional taxonomist for identification?

Were sites where data were collected submitted with relevant GIS information (lat/long, PLS, or map)?

Are data are less than 5 years old?

Date ranges covered by data: from ______________ to ________________

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Appendix E. Temperature Frequency of Exceedance Calculation Procedure

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Memorandum

To: DEQ Water Quality Staff

From: Don Essig, Water Quality Standards Program Coordinator

Date: January 25, 2007

Re: Temperature Frequency of Exceedance Calculation Procedure, 3rd Revision

This memo builds on and strives to clarify application of the policy on allowable frequency of exceedance contained in WBAG II. It represents DEQ’s further interpretation of Idaho’s water quality criteria for temperature. The second revision of the original Oct. 22nd, 2001 memo addressed cases in which greater than 10% exceedance are apparent within a partial data record. This third revision expands that section to be more precise about the logical decisions that can be made.

The 10% criteria exceedance policy is for 303(d) listing and de-listing decisions. It is still necessary to target the current water quality criteria in crafting a TMDL. However if your frequency of exceedance of the temperature criteria is less than 10%, and there is no other evidence of thermal impairment, then it is possible to move for de-listing rather than proceed with a temperature TMDL. If you proceed with a temperature TMDL, then during implementation of the TMDL the water will eventually be reassessed. In that reassessment the goal for temperature would be considered met if criteria exceedances fall below 10% for a 90 percentile air T year (per Idaho’s Air T exemption).

Frequencies of temperature exceedance must be calculated on the metric of interest (e.g., the frequency of daily maximum stream temperature exceeding daily maximum criteria, or the frequency of seven-day average, aka weekly, maximum temperatures exceeding the maximum weekly maximum criterion). Except for single daily maximum criteria, this requires data processing of the raw temperature record before counting exceedances. What follows is more detail on calculation of a criteria exceedance frequency for water temperature.

Time periods of interest

For ***cold water aquatic life*** the summer period of June 21st through September 21st shall be considered the period of interest on which to gage frequency of exceedance. This 93 day period acknowledges the natural seasonal progression of water temperature in which peak water temperature typically occur between July 15th and August 15th, with progressively cooler temperature generally to either side.

For ***salmonid spawning*** the time period of interest is the entire spawning and incubation period ***at a given site***, but not less than 45 days. Forty five days is set as a minimum spawning period as this allows 2 weeks for spawning and an additional month for egg incubation. The frequency of exceedance of salmonid spawning criteria should be based on the entire spawning and incubation period of the site in question. Note that the entire spawning period at a site, even when greater than 45 days, will usually be shorter than the broad periods that were formerly in Idaho's water quality standards. Those broad periods, often still used as rules of thumb, were intended to encompass spawning times statewide and from valley to mountain, not what would occur at any particular site.

Critical time period

In absence of data to the contrary, critical periods for water temperature are defined as follows. For ***cold water aquatic life*** the critical time period is from July 15th through August 15th, the time period when most streams reach there highest temperature of the year. Spawning often occurs when water temperatures are in a spring or fall transition. Therefore, for ***salmonid spawning*** the critical time period is the 22 days at the warmer end of the spawning period. For spring spawners this will be at the chronological end of the period, while for fall spawners this will be at the chronological beginning of the period.

Complete data records

In order to calculate and evaluate a percent exceedance for temperature an adequate data record is needed. The best situation is to have a complete data record for the entire time period of interest as defined above and that should be the goal in any future monitoring effort. However it is acknowledged that this is not always the case, even when planned. Much historical data will not have been collected with this policy in place. Therefore the following allowances are made for evaluating partial data records.

Partial data records

Although partial data records are inadequate for measuring a frequency of exceedance for the full time period of interest, in some cases it will be possible to infer whether the frequency is less than or greater than 10% and therefore still evaluate the frequency of exceedance threshold for compliance with Idaho's temperature criteria. What you can infer depends on whether the partial data record includes the critical time period (see above) or not.

When critical time period is covered

If the partial data record includes the critical time period it is possible to logically infer a frequency of exceedance less than or greater than 10%.

If the frequency of exceedance is less than 10% for the partial data record and for ***cold water aquatic life*** if that partial data record includes the critical time period of July 15 thru August 15th inclusive, then it can be assumed the frequency of exceedance is less than 10% for the entire summer period of interest. Similarly, if the data record during ***salmonid spawning*** includes the warmest 22 days of the spawning period (end or beginning of the time period depending on whether spawning extends into spring or fall) and the frequency of exceedance is less than 10%, then it can be assumed that the frequency of exceedance is less than 10% for the entire spawning period.

If the measured frequency of exceedance is greater than 10% for a partial data record it may still be possible to infer a frequency of exceedance less than 10% for the entire period of interest. To do so one must carefully examine the data record and consider seasonal trends in temperature.

If the last (or first) seven consecutive days at the cool end of the record show no exceedances of criteria, then based on the seasonal progression of temperature it may be assumed the entire following (preceding) unmonitored portion of the time period of interest is also without exceedances. In which case an inferred frequency of exceedance may be calculated using the entire period of interest as the denominator. For example, let's say the period of interest is a spawning period which begins May 1st and ends June 30th. The available data record however begins June 1st and shows 5 exceedances of a 13°C daily maximum criterion. The calculated frequency of exceedance is 5/30 = 17%. Further examination of the data record reveals that all 5 exceedances occurred after June 15th with no exceedances in the first 7 days of June, at the cooler beginning of the record. It can therefore be assumed that had data been obtained for May it would show no exceedances of the criterion. The inferred frequency of exceedance for the entire spawning period would be 5/61 = 8%, thus no violation of standards.

Data records that include only cooler portions of a time period of interest are not common, so that possibility is not detailed here. However, by logical extension one could infer a frequency greater than 10% when the measured frequency is less than 10%.

When critical time period not covered

This is the most data limited situation; consequently the possibilities for inference are more limited. Partial data records that do not include the critical time period are inadequate for inferring a frequency of exceedance less than 10 %.

On the other hand, such partial data records may be sufficient to estimate a frequency of exceedance that is at least 10% and thus a violation of criteria. This is logical anytime the observed number of days over criteria in the partial record is greater than the number of days necessary to reach 10% exceedance for the entire period of interest. Take ***salmonid spawning*** for example; if a partial data record includes 41 days of a 90 day spawning period, and 15 of those days are over criteria then the frequency of exceedance is at least 15/90 = 17%, even if it were assumed the 49 days without data met criteria. For ***cold water aquatic life*** a frequency of exceedance greater than 10% is documented with ten days of exceedance, even if those ten days are the only data available (10/93 = 11%). Data records less than 10 days for ***cold water aquatic life*** or less than 10% of the applicable spawning period are inadequate to show a frequency of exceedance that is at least 10% and are therefore inadequate to determine violation of Idaho's temperature criteria.

CC: Michael McIntyre

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Appendix F. Regional Application of the Idaho Water Quality Standards Temperature Exemption

#	County Name	Station Name	Latitude (DD)	Longitude (DD)	90th % MWMT (°F)	90th % MWMT (°C)
1	Ada	Boise Air Terminal	43.5666	-116.2405	101.61	38.67
		Boise - Lucky Peak Dam	43.5253	-116.0542	103.23	39.57
		Swan Falls Dam	43.2436	-116.3784	105.86	41.03
2	Adams	Council	44.7441	-116.4326	101.89	38.83
		New Meadows	44.9714	-116.2933	95.84	35.47
3	Bannock	McCammon	42.6447	-112.1920	97.42	36.34
		Pocatello	42.8916	-112.4086	100.01	37.79
4	Bear Lake	St. Charles (Lifton Pumping Station)	42.1230	-111.3138	90.13	32.29
5	Benewah	Saint Maries	47.3165	-116.5789	98.14	36.74
6	Bingham	Aberdeen	42.9536	-112.8253	96.59	35.89
		Blackfoot	43.1969	-112.3530	96.90	36.06
		Fort Hall	43.0427	-112.4133	95.87	35.49
7	Blaine	Ketchum	43.6841	-114.3602	91.07	32.81
		Hailey (Ohio Gulch)	43.6008	-114.3158	93.72	34.29
		Picabo	43.3002	-114.0667	96.23	35.69
8	Boise	Garden Valley	44.1011	-115.9694	102.08	38.93
		Idaho City	43.8383	-115.8320	98.40	36.89
		Lowman	44.0828	-115.6186	98.55	36.97
9	Bonner	Cabinet Gorge	48.0863	-116.0573	94.97	34.99
		Priest River	48.3512	-116.8354	94.43	34.69
		Sandpoint	48.2943	-116.5627	92.76	33.75
10	Bonneville	Idaho Falls	43.5134	-112.0129	96.07	35.59
		Idaho Falls - Fanning Field	43.5164	-112.0672	95.66	35.37
		Swan Valley	43.4372	-111.2791	95.51	35.29
11	Boundary	Bonners Ferry	48.6928	-116.3104	96.45	35.80
12	Butte	Arco	43.6355	-113.2988	95.37	35.20
		Craters of the Moon	43.4650	-113.5580	94.58	34.76
		Idaho National Laboratory	43.5316	-112.9422	97.95	36.64
13	Camas	Fairfield	43.3428	-114.7899	94.89	34.94
14	Canyon	Deer Flat Dam	43.5765	-116.7475	96.93	36.07
		Nampa (Sugar Factory)	43.6039	-116.5753	101.87	38.81
		Parma	43.8023	-116.9442	102.61	39.23
15	Caribou	Grace	42.5872	-111.7275	94.87	34.93
		Soda Springs	42.6513	-111.5833	94.62	34.79
16	Cassia	Burley Municipal Airport	42.5333	-113.7667	97.67	36.49
		Oakley	42.2333	-113.8919	93.83	34.35
17	Clark	Dubois	44.2436	-112.2005	94.43	34.69
18	Clearwater	Dworshak Fish Hatchery	46.5023	-116.3216	102.53	39.18

#	County Name	Station Name	Latitude (DD)	Longitude (DD)	90th % MWMT (°F)	90th % MWMT (°C)
		Elk River	46.7823	-116.1796	94.10	34.50
		Pierce	46.4922	-115.8006	94.00	34.44
19	Custer	Mackay	43.9180	-113.6316	92.92	33.85
		Stanley	44.2205	-114.9341	89.67	32.04
20	Elmore	Anderson Dam	43.3572	-115.4523	100.82	38.23
		Glenns Ferry	42.9404	-115.3230	105.84	41.02
		Mountain Home	43.1261	-115.7119	104.31	40.17
21	Franklin	Preston	42.0933	-111.8683	96.30	35.72
22	Fremont	Ashton	44.0424	-111.2739	91.50	33.06
		Island Park	44.4189	-111.3714	90.91	32.73
		Saint Anthony	43.9518	-111.6789	93.15	33.97
23	Gem	Emmett	43.8544	-116.4663	101.98	38.88
24	Gooding	Hagerman	42.8114	-114.9239	104.44	40.25
25	Idaho	Elk City	45.8356	-115.4610	95.80	35.44
		Grangeville	45.9289	-116.1216	94.56	34.76
26	Jefferson	Hamer	43.9663	-112.2641	96.56	35.87
27	Jerome	Hazelton	42.5972	-114.1378	98.79	37.11
		Jerome	42.7325	-114.5192	101.21	38.45
28	Kootenai	Bayview	47.9803	-116.5594	92.07	33.37
		Coeur d'Alene	47.6806	-116.7992	98.69	37.05
29	Latah	Moscow	46.7280	-116.9557	97.01	36.11
		Potlatch	46.9603	-116.8550	95.01	35.00
30	Lemhi	Gibbonsville	45.5395	-113.9274	94.25	34.59
		Salmon	45.1875	-113.9008	97.50	36.39
31	Lewis	Nez Perce	46.2324	-116.2430	93.30	34.06
		Winchester	46.2381	-116.6232	89.82	32.12
32	Lincoln	Richfield	43.0527	-114.1580	97.57	36.43
		Shoshone	42.9383	-114.4169	101.55	38.64
33	Madison	Rexburg	43.8083	-111.7892	94.20	34.56
34	Minidoka	Paul	42.6283	-113.7622	97.26	36.26
35	Nez Perce	Lewiston (Airport)	46.3747	-117.0156	102.46	39.15
36	Oneida	Flint Creek	42.0792	-112.1833	99.66	37.59
		Malad City	42.1492	-112.2873	99.17	37.32
37	Owyhee	Bruneau	42.8819	-115.8017	103.44	39.69
		Mud Flat	42.6000	-116.5500	94.15	34.53
		Reynolds	43.2064	-116.7495	97.01	36.11
38	Payette	Payette	44.0763	-116.9312	102.70	39.28
39	Power	American Falls	42.8571	-112.8801	96.31	35.73
		Massacre Rocks	42.6680	-112.9980	100.81	38.23
		Pocatello Regional Airport	42.9202	-112.5711	98.20	36.78
40	Shoshone	Kellogg	47.5340	-116.1221	98.71	37.06
		Wallace - Woodland Park	47.4754	-115.9313	93.81	34.34

#	County Name	Station Name	Latitude (DD)	Longitude (DD)	90th % MWMT (°F)	90th % MWMT (°C)
41	Teton	Driggs	43.7306	-111.1125	90.10	32.28
		Tetonia	43.8563	-111.2769	88.85	31.59
42	Twin Falls	Buhl	42.6006	-114.7453	97.73	36.51
		Hollister	42.3528	-114.5739	94.41	34.67
		Twin Falls	42.5458	-114.3461	94.62	34.79
43	Valley	Cascade	44.5228	-116.0481	92.52	33.62
		McCall	44.8871	-116.1046	92.21	33.45
44	Washington	Brownlee Dam	44.8365	-116.8981	107.15	41.75
		Cambridge	44.5734	-116.6754	103.40	39.66
		Weiser	44.2456	-116.9696	103.22	39.56